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NOTES AND COMMENTS.

The Age of Laboratories.

In the course of a lecture given at the opening of a laboratory for clinical medicine in Philadelphia (see *Johns-Hopkins Hospital Bulletin*, no. 58, January, 1896), Dr. W. H. Welch, Professor of Pathology in the University, expressed regret that a historical study of the development of laboratories had not yet been undertaken. The earliest account that we have of laboratories is of those associated with the magnificent library and museums of Alexandria. A vast amount of anatomical work was performed there, and, from the fragmentary evidence that is left us, it seems plain that physiological investigation was conducted in a fashion that would justify some of the extremest diatribes of the Anti-Vivisection Society's emissaries. But if we leave anatomy and chemistry out of account, laboratories for the combined purposes of research and teaching are creations of the present century, while the greater number of them date from after the year 1870. A mere list of the subjects for the study of which there exist properly-equipped special laboratories would be of great interest, and would astonish even the most well-informed man. No doubt an enormous amount of valuable work has been done in cellars like those in which Bernard began his investigations in Paris, or Lord Kelvin his physical investigations at Glasgow. Men of first-rate ability transcend the conditions under which they work, but the average man who could do only bad work under bad conditions, if placed in a first-rate laboratory will turn out good work. Professor Welch quotes what Wurtz said of the money expended upon laboratories: "It is a capital placed at a high rate of interest, and the comparatively slight sacrifice imposed upon one generation will bring to following generations increase of well-being and knowledge."

Species-work as Educational Training.

It is a novel experience to find 'systematic' study of species included in an educational curriculum. In a paper entitled "The Bees of the genus Perdita, F. Smith" (*Proc. Acad. Nat. Sci. Philadelphia*,

January, 1896), Mr. T. D. A. Cockerell explains his reasons for adopting such a method in teaching entomology to the students of the New Mexico Agricultural College. So far as we can find out, systematic work, as such, is not a part of the biological course in any of the well-known British morphological laboratories. It certainly has no place in the courses prescribed for beginners, or for medical students, and although in these days, when the study of variation is receiving great attention, senior students can hardly avoid some species-work, still the species-work comes as an accidental appanage of the study of individual variations. While we are fully willing to admit with Mr. Cockerell that in the hands of a competent teacher species-work might become a valuable mechanism for education, we are not prepared to agree that it should be a substitute for a more general course. Still, to many minds the exact study of the concrete specific differences among a limited set of organisms would give a certain definiteness, and what would be appreciated as practicalness, to the study of biology. We should welcome the addition to an elementary course of the study of a prescribed set of species. A genus of reptiles, or bees, or butterflies, might be taken that included a limited number of species, and the characters of the species should be taught dogmatically and learned upon the specimens, just as the elementary student of anatomy learns the characters of human bones.

On the other hand, in the case of the advanced student, a larger and more scientific study of species should be as natural a part of his training as the study of embryology, or of dentition. Along with this the methods of proper description, the rules of nomenclature, and the chief difficulties in the way of identifying species, should be studied. The relation of individual variation to varieties and to species in a definite group should certainly be included. Morphology and the study of species cannot be divorced. At some period of his career the most abandoned morphologist, or the most devoted systematist, cannot avoid passing over into the problems of the other branch of biology, and this should be recognised in his training.

HABITS AS DIAGNOSTIC OF SPECIES.

PRIOR to Mr. Cockerell's study of *Perdita*, a genus of bees, seventeen North American species were known, two of which were not considered valid; he now recognises seventy species: twenty-six in both sexes, twenty-six only in the male, eighteen only in the female; twenty-three being from single specimens. Without examination of the material it may be presumptuous to criticise, but it must be confessed that in the absence of knowledge of nesting habits, insufficient evidence as to double broods, and silence as to the effects of parasites on structure, this wholesale coining of new species appears rash and likely to lead to confusion hereafter. It must, however, be admitted that Mr. Cockerell has done good service in calling attention

to the value and importance of habits in the discrimination of species very closely similar in anatomical structure. Having laid it down as a rule that each species of *Perdita* visits normally but one species of flower, he remarks, "There is no essential difference between those characters called specific and those called varietal; in fact, the very same kind of difference which marks species in one group, may only mark varieties or mutations in another. Thus we come to see that the *essential distinctions between species are physiological* [the italics are our own], the morphological ones being only valid for diagnostic purposes just so far as they happen to coincide with the physiological." We are not quite sure that we fully understand what "physiological" means here; the context and instances lead us to suppose the word to mean "habits in relation to flowering plants." The chief examples are the two species, *P. zebrata*, found only on *Cleome serrulata*, and *P. bakeræ*, occurring on *Solidago* and *Helianthus*. These two species are stated to be extremely alike, especially in the female sex, nor was it until a specimen had been taken on *Solidago* that two species were recognised. It appears, however, that the genitalia have not been examined in this work, except as an afterthought; and, indeed, the tardy examination of the male genitalia of the two species in question at once revealed "apparently good distinctions." It is somewhat startling to find organs which of all others are likely to yield good distinctions so entirely neglected. In the separation of species from species nothing can be more efficient than structural alterations which may render sexual intercourse between diverging groups a physical impossibility. In view of this admission Mr. Cockerell's "physiological species" is an unwarranted and unjustifiable expression. Nevertheless, it shows the importance of accurately observing the habits of living animals, inasmuch as differences being known in this respect may lead to a reasonable suspicion of structural distinctions, and to more careful search among a few examples for features which might otherwise be overlooked or only ascertained by dissection and ruin of every specimen. For instance, if doubt were felt as to any specimen being *P. zebrata* or *P. bakeræ*, a note stating it to have been found on *Cleome serrulata* would at once determine in favour of the former without the extraction of the male genitalia, now that it is known that these present good distinctions.

Evolving Species.

It is tolerably clear that Mr. Cockerell is right in recognising two species in the case just mentioned, though he does not attach so much importance to genitalia as others would in similar cases, yet, in discussing those and other instances of like kind which he has treated in like manner, he states, "We have, indeed, the process of evolution going on under our eyes, the puzzling forms being those which have only lately segregated themselves and have not yet developed striking

peculiarities." Now, if the process of evolution is going on under our eyes, surely it is not correct to treat the *evolving* species as though already *evolved*; in other words, according to his own showing, Mr. Cockerell should have grouped both forms under one specific name, or at the most have designated one as a variety of the other. It is a curious instance of two errors, one of omission and the other of commission, leading to a correct result: close similarity of species such as these can be adequately explained by "convergence" and "arrested divergence." We should like to know how Mr. Cockerell would have treated the entire Animal Kingdom had we been blessed with preserved specimens of all the forms that have peopled this earth from the beginning. Judging by his present remarks, it looks as though offspring and parent would find themselves under different names with "n.sp. Cockerell" tacked on, especially if the enterprising younger generation consumed carrots while the parents stuck to thistles. Let it not be thought that we consider Mr. Cockerell's *results* wrong: it is the style of argument and confessed neglect of important structural characters that we condemn, but pardon for the sake of the otherwise valuable and suggestive paper in which they occur.

NATURAL HISTORY *versus* SYSTEMATIC WORK.

WE are unconscious of guilt in the matter referred to by Professor Williston in his interesting letter, printed on page 70 of this number. We quite agree with him that the time has gone when it was possible for instructed morphologists and systematists to sneer at each other. In the present case, we think that the sneers he finds in our review are due to a strained reading of it: the italics into which he has put the words, "every other scientific man," are his own, and give the phrase a meaning we did not intend; the expression, "a necessary evil," is also Professor Williston's, and not ours. Our remarks had a definite reference to schoolboys, and we remain unshaken in the conviction we expressed, that those of them who confine their attention to collecting all the forms they can lay hands upon, and determining them, as is the custom of their kind, by comparison with pictures in a book, are not engaged in a pursuit of such educational or scientific value as those who observe the habits and investigate the structure of the animals and plants around them.

Although we understand it as a fair retort to what Professor Williston imagines us to have implied, we cannot see great value in his assertion that, at "the present time, the 'systematist' represents the highest type of the naturalist." The real naturalist, whatever be the chief direction of his work, occasionally pursues other branches of the subject, and in any event gains the respect of other naturalists by the quality rather than by the subject of his labours.

American Criticism of Romanes.

Professor Brooks is not the only American biologist who dissents from the views expressed in the last volume of Romanes' "Darwin and after Darwin." In *Science* (1896, pp. 438 and 538), Professor Mark Baldwin, a distinguished authority upon psychology, gives weighty reasons against Romanes' interpretation of instincts as lapsed intelligence, as, in fact, the inherited memory of acquired habits. Professor Baldwin's criticism is so condensed that it would be impossible to give a short account of his arguments. He discusses the relation of intelligence to coadaptations, the relative utilities of instinct and intelligent actions, and all the points that Romanes raised in support of his assumption of the Lamarckian factor. He comes to the conclusion that "on the more general definition of intelligence, which includes in it all conscious imitation, use of material instruction and that sort of thing (the vehicle of 'social heredity') . . . we still find the principle of natural selection operative and adequate, possibly, to the production of instincts and reflexes."

Retzius on the Inheritance of Acquired Characters.

Dr. Gustaf Retzius devotes a chapter of his latest publication ("Biologische Untersuchungen," neue Folge, vii., Jena, 1895), to the question of the inheritance of acquired characters. After a brief historical introduction, he describes the investigations of Manouvrier, Collignon, Sir William Turner, Arthur Thomson, and Havelock Charles into a number of peculiarities of human skeletons. The characters are all well known to anatomists, and are such as the presence of an additional facet on the distal end of the tibia, where it rubs against the neck of the astragulus in cases like that of the Veddah, who is able to bend his foot nearer the shin than is possible for most men; or that condition of the knee where the facets on the upper end of the tibia are not horizontal, as in normal Europeans, but are inclined backwards. It has been shown that these and a number of other conditions are common among the lower races; they have been found in fossil skeletons, and among some of the monkeys. Recently it has been argued that some of the characters are excellent instances of an inheritance of acquired characters. Dr. Havelock Charles, for instance, associates the bent condition of the knee with the habit among many of the lower races of resting in a sitting posture, with the knees bent extraordinarily far outwards. He concluded that the abnormal condition was a result of the peculiar attitude, and, as he found it to exist in embryos of the races which had the adult habit, he suggested that a character acquired by adults had been transmitted to descendants. It occurred to Dr. Retzius that abnormalities found among so many different races, among ancient and modern men, could scarcely be a character acquired recently and convergently. He examined a large number of Swedish

embryos, and found among them well-marked traces of all the peculiarities; in some cases, indeed, the fœtus showed the Veddah and Hindu peculiarities in an absolutely typical form. He believes, therefore, that the bent tibial facets and accessory articulation with the astragalus, and so forth, are not instances of an inheritance of acquired characters, but are an atavistic inheritance of conditions once universal.

Dr. Retzius believes, in fact, that a reversed account of the true state of affairs has been given. It is modern conditions, the habit of sitting on chairs, and so forth, that is gradually altering the typical character of the bones of the lower limbs. The modern fœtus retains the ancestral condition, and the modern characters are acquired later in life. On the other hand, although we do not quite follow his argument, he thinks that an instance of the existence of the Lamarckian factor is to be found in the changes occurring in ourselves. He is severe, however, on those writers who attach great importance to the changes produced by mechanical factors, by strains and stresses and so forth. He insists upon the historical factor, upon the internal forces that direct the development. We commend his chapter, of which this is only the slightest sketch, to our readers who are interested in heredity.

Warning Colours and Mimicry.

Mr. Frank Finn has continued his experimental investigations into the palatability of warningly coloured insects (*see* Nat. Sci., vol. viii., p. 231). His most recent experiments are published in the *Journal of the Asiatic Society of Bengal* (1896, p. 2). Using the common garden lizard of India, *Calotes versicolor*, both in captivity and in freedom, he tempted its appetite with all manner of plain and parti-coloured insects. The details of each experiment are given, and they certainly corroborate Mr. Finn's conclusion that, in the case of butterflies, at any rate, warning colours and unpalatability so far as lizards are concerned do not go together. Mr. Finn was careful to use common butterflies, and the lizard in question is accustomed to take butterflies in the natural state. We hope that Mr. Finn will proceed with his experiments. Warning colours, mimicry, and so forth are among the chief contributions of the much-praised field-naturalist to the theory of evolution, and, like many of the conclusions of the field-naturalist, they require the more careful investigation of the trained expert.

American Entomology.

In our June number we gave some account of the Chinch-bug, *Blissus leucopterus*. Mr. S. A. Forbes' Report on Noxious and Beneficial Insects of the State of Illinois for 1893–4 is chiefly devoted to details of experiments in innoculating Chinch-bugs with fungoid disease. The

idea of using fungi as allies against insect pests has been worked in America for several years, but the results do not seem to have been as satisfactory as might have been expected. Naturally, the insects are most injurious in dry weather, while the fungus will only flourish when the air is moist. And the spread of *Sporotrichum globuliferum* among Chinch-bugs in Illinois was not shown to be hastened by artificial innoculation; under favourable conditions the disease was propagated among the insects from spores normally present.

The Mediterranean Flour Moth, *Ephestia Kühniella*, Zell., is quite a modern discovery, having been described only in 1879. Mr. W. G. Johnson (*App. to 19th Rep. of State Entom. Ill.*) has just issued an interesting summary of our knowledge of the moth, which has already given rise to a bibliography of seventy-nine papers. The species multiplies in flour-mills to an alarming extent, and the armies of caterpillars, trailing after them silken threads, bind the meal into tangled masses, stop the machinery, and require the strongest measures in order to destroy them. When the moth was first found in German mills, the Continental naturalists suggested North America as its original home, but the Transatlantic entomologists are not eager to accept this honour for their country, and point out that the insect did not trouble American millers until some years after it had appeared in Germany and England. Curiously enough, the American states most affected, New York and California, are the width of the Continent apart. Before appearing in these, however, it established itself in Canada. The colloquial name of the insect suggests the Mediterranean shores as its home, and there seems reason to suspect that it may have spread from South European ports. But like many other "domestic animals" its origin remains a mystery, which naturalists might like to see cleared up, though millers would probably prefer that future research on the subject should cease from want of material.

Messrs. L. O. Howard and C. L. Marlatt have given in Bulletin No. 3 (n.s.) of the U.S. Department of Agriculture a full account of the San José Scale-insect (*Aspidiotus perniciosus*, Comst.) First observed in 1870 in California, whither it was believed to have been introduced from Australia, this coccid has spread eastward to the Atlantic states. Its rapid rate of multiplication, and the difficulty of checking its ravages, have made it one of the most dreaded enemies of the American fruit-grower. In the Pacific region, the insect can be, to some extent, destroyed by washes, but in the east it is often necessary to burn infested trees to stop the plague from spreading. The life-history of the scale, its habits, and its natural insect-enemies (a minute hymenopteron and a ladybird) are described in the thorough manner which we expect from the Washington Division of Entomology.

Bulletin No. 2 of the same series is devoted to the Proceedings of the seventh annual meeting of the Association of Economic

Entomologists. The union of the workers in the different American States in such an association must be highly beneficial, and European students of the subject are welcome as foreign members. The address of the President, Mr. J. B. Smith, of New Brunswick, N.J., dealt with the general prospects of the science and the best means for making the researches of naturalists useful to farmers. Several papers of considerable interest were read.

Systematic work of a high order is turned out by several of the American economic entomologists. The first two bulletins of the new "Technical Series," issued by the U.S. Department of Agriculture to replace the scientific papers formerly published in *Insect Life*, are written by Mr. L. O. Howard, and deal with the North American Aphelininæ (a sub-family of Chalcididæ) and Eurytominæ. From the Massachusetts Agricultural College, Dr. C. H. Fernald has sent us a monograph of the North American Crambidæ, excellently illustrated with structural figures and coloured plates.

THE SUN-HATERS.

IN his presidential address to the Biological Section of the Australasian Association for the Advancement of Science, held at Brisbane in 1895, Professor Arthur Dendy dealt with some of the features of that part of the fauna to which he has applied the term "cryptozoic." This word is but a few years old, and refers to Kipling's "life of the Middle Jungle, that runs close to the earth or under it, the boulder, burrow, and tree-bole life," and includes the species which, for purposes of protection or in search of food, frequent dark, humid cool haunts, sheltered from the light of day. To give a more comprehensive definition than this is hardly possible, seeing that the cryptozoic fauna imperceptibly blends with what by way of contrast may be called the "phanerozoic," just as the littoral fauna of the sea blends with the pelagic, and the pelagic with the bathybial.

According to Professor Dendy, the members of this fauna have been derived from nearly all the principal groups of the animal kingdom, the only character which they possess in common being their hatred of exposure. So, too, have recruits been levied from many distinct faunistic groups; but it is possible to classify the members of this heterogeneous mob into four sections, distinguished by their mode of origin. (1) Representatives of typically terrestrial groups of animals which are dominant at the present day. These may be found at all stages of development, and include many insects, spiders, slugs, snails, and the like. (2) Surviving members of extremely ancient groups which are now almost extinct, *e.g.*, *Peripatus*, and possibly scorpions. (3) Immature forms of terrestrial animals which are not cryptozoic in the adult condition; or, in other words, the larvæ of phanerozoic species. (4) Isolated representatives of typically aquatic groups of animals which have as yet become but

little modified in accordance with their new mode of life. Of this section, the most interesting representatives are the land Planarians and land Nemertines, and the woodlice. It is to these animals and *Peripatus*, both of which he has made special objects of study, that Professor Dendy chiefly confines himself in his address, merely bestowing a passing remark upon the insects, spiders, centipedes, millipedes, snails, earthworms, not to mention vertebrates, that frequent the cryptozoic haunts of Australia and New Zealand. After discussing what is known of the habits of the *Peripatidæ*, the author touches upon the question of the generic and specific distinctions of this interesting family. We venture to think, however, that his opinion on the former topic is robbed of much of its value by his apparent failure to realise that the only criterion we have as to the importance for purposes of classification of a structural character is its constancy. Apart from that attribute, Nature knows nothing of good or bad, great or small.

In conclusion, Professor Dendy urges upon naturalists in Australia and New Zealand the advisability of making the most of their time and opportunities in securing representatives of the cryptozoic fauna ere it be exterminated by the wholesale destruction of forests that is going on. "For, when the clearing process is complete and the last logs have disappeared from the ground, we may expect to lose sight for ever of many peculiar forms which formerly dwelt there."

Recent Work on the Foraminifera.

Continuing the work on the Crag, referred to by us in our February number, H. W. Burrows published a paper dealing with the stratigraphy of the Crag of Suffolk, with especial reference to the distribution of the Foraminifera, in the *Geological Magazine* for November, 1895. In conjunction with his colleague, Richard Holland, he has now enabled us to deal with Prestwich's, and with Clement Reid's division of these strata from the point of view of their Foraminifera. As these beds are treated from their geographical, as well as from their stratigraphical, relations, the paper has considerable value. Other Pliocene Foraminifera have been examined by Fornasini in the *Memorie d. R. Accad. Sci. Ist. Bologna*, volumes v. and vi. (1895, 1896), who presents us with his views on *Bigenerina robusta*, *Textularia candeiana*, and *T. concava*. His papers are illustrated with two excellent plates. A further service has been rendered by Fornasini in the elucidation of O. Costa's paper "Foraminiferi della marna del Vaticano," 1855 (1857). He discusses this in *Palæontographia Italica* for 1895, and re-figures many of the doubtful forms. Costa's interesting unnamed *Truncatulina* ("Paleont. Napoli," part 2A, pl. xxi., f. 11) has also occupied Fornasini's attention, and he has determined it to be the *T. variabilis* of d'Orbigny; this paper appears in the *Rivista Ital. Paleont.*, April, 1896. A privately-printed note on

Frondicularia frondicula, n.sp., also appeared from the pen of this enthusiastic worker in February, 1895, but has only just reached us. Frederick Chapman continues his monograph on the Gault forms (*Journ. R. Micros. Soc.*, 1896) and presents his views on the *Cristellariæ* and *Polymorphinæ* of this deposit. As regards *Polymorphina* we hope shortly to be in the possession of a masterly and elaborate account of this genus from the pen of Professor Rupert Jones and Mr. Chapman; a paper on the subject having been read before a recent meeting of the Linnean Society. The paper is, in part, a continuation of the 1869 paper of Brady, Parker, and Jones, published by the same Society, and deals chiefly with those wild-growing forms familiar to students of the group. The authors have also devoted considerable time and attention to *Ramulina*, a closely-related form, and the publication of the paper will give, for the first time, a connected account of this interesting genus. In the *Geological Magazine* for September, 1895, Professor Jones, when reviewing some Reports of the Geological Survey of Iowa, took the opportunity of calling attention to the wide range of certain Cretaceous Foraminifera in the two hemispheres.

The working out of reticulate Rhizopoda in Australia is continued by Walter Howchin, who treats of three new Carboniferous forms, *Cornuspira*, *Nodosaria* and *Frondicularia*. We cannot accept the *Cornuspira* because of the chambering shown in the figure, but the *Frondicularia* is interesting as carrying back the genus from Liassic times. These tests come from the shales of the Irwin River, and are described and figured in *Trans. R. Soc. S. Austral.*, 1895. In the same paper Howchin figures a *Haplophragmium* and a *Patellina* from the Cretaceous of Hergott Springs, 441 miles north of Adelaide. We do not see how the first specimen can be separated from the common and very variable English species; the *Patellina* is of a much greater interest. A list from the Eocene beds of Cape Otway, at p. 114 of the same journal, shows 64 forms.

A new author on this group, Henrik Munthe, contributes two papers on Foraminifera to the *Geol. Fören. Stockholm Förhandlingar* (xviii., 1896). Munthe treats of the faunas of the "Yoldia mergel" and the Chalk, and wisely contents himself with listing known forms, and not making new names.

As a matter of considerable interest, we may conclude this note by mentioning that Mrs. Williamson has presented to the Zoological Department of the British Museum the almost complete series of figured specimens illustrative of the late Professor W. Crawford Williamson's Monograph of British Recent Foraminifera (Roy. Soc., 1858). The series also includes the types of his *Lagenæ* (1848); Levant (1848); and his papers on the structure of the test. The specimens are, in most cases, loosely mounted in cardboard cells, but Mr. Sherborn, who was consulted about the slides, has, we understand carefully ascertained the identity of the types.

The Rabbit Plague in the United States.

The great plains and deserts of the Western United States are inhabited by several species of large hares, locally known as "Jack Rabbits." Although they are by no means so destructive or so impossible to cope with as are the rabbits in Australia, they are sufficiently abundant to do great damage, especially to vineyards and cultivated crops. The National Department of Agriculture has recently issued a bulletin bearing the name of T. S. Palmer, M.D., the assistant chief of division, and dealing with the whole question of damage, habits, and means of destruction. It is illustrated by useful maps and plates, and, like all the bulletins of the Agricultural Department of the United States, makes us mourn the inefficiency of what we are pleased to call our own Department of Agriculture.

The various species of "Jack Rabbits" are all more or less alike in habits, and all feed largely upon bark or herbage. "Among the greasewood on the alkali flats, north-west of Great Salt Lake, or on the cactus-covered deserts of Arizona, the Jack Rabbits are almost as fat and sleek as when feeding in the alfalfa patches and vineyards of Southern California. If necessary, they can travel long distances for food, but, as they seldom drink, scarcity of water causes them little inconvenience, and the juicy cactus 'pads' or ordinary desert herbage furnish all the moisture necessary to slake their thirst. They are fond of vegetables and alfalfa, and, when these can be had, they quickly abandon their usual food and establish themselves near the garden or cultivated field. Their fondness for tender bark makes them particularly destructive in the orchard and vineyard, where they are likely to do irreparable injury by girdling the young fruit trees and vines." The best means of preventing their ravages, and the only means which may be relied upon, is the use of rabbit-proof fences. Occasionally, under favourable circumstances, large numbers may be destroyed by drives. Descriptions of some of the largest drives are given in this pamphlet, and it seems that twenty thousand have been killed at a time. But such methods only reduce numbers; they cannot exterminate the pests. Bounty laws were found on the whole to be unsatisfactory, as indeed, is the Australian experience. Enormous sums of money have been expended with very little benefit, and it seems impossible to prevent systematic fraud. Poisoning and the introduction of diseases have failed, and it appears that co-operation among farmers is the best means, while advantage should be taken of opportunities when the rabbits are already reduced in numbers by natural epidemics or by specially hard seasons. The Report urges strongly the commercial utilisation of rabbits, so making the creatures bear part of the burden of their own extermination.

A Danger of Clover.

The intestinal calculi and hair balls of horses and cattle are well known, but Mr. F. V. Coville, of the U.S. Department of Agriculture,

has recently called attention to a new source of trouble in the hairs of the calyx of the crimson clover, *Trifolium incarnatum*. Up to the time of flowering these hairs are soft and flexible, but they afterwards become stiff and almost needle-like in character. If hay made from over-ripe clover is fed to cattle, these hairs, which are barbed, form balls of a tough, felt-like consistency three or four inches in diameter, which ultimately cause death through peritonitis or some related ailment. The first deaths from this cause in the United States were noted in 1895, and farmers are cautioned against allowing this clover to become too ripe before making it into hay.

The tops of the spineless cactus, *Anhalonium Lewini*, of Southern Texas, which contain an active poison, serve as articles of trade among the Indians, who use them as an intoxicant or stimulant during their dances or religious ceremonies. Mr. Coville considers that, in the absence of spines, this bitter, poisonous property serves as a protection against animal enemies.

The Horse's Hoof.

The hoof of quadruped mammals is so unique in its way that any contribution towards a knowledge of its histology and development is always welcome. Professor Mettam, in his presidential address to the Scottish Microscopical Society, published *in extenso* in the *Veterinarian* of the current year, gives an account of his original observations on the subject, and lays special stress on the mode of development of those horny lamellæ which are to be seen running in a vertical direction on the inner surface of the wall of the hoof of the horse. The surface of contact of the corium or dermis with the epidermis is, in the early stages of development, smooth and devoid of ridges. This has always been assumed in the past, but it has been left for Professor Mettam to demonstrate the fact, and to fix the age at which it is most clearly seen, viz., at seventy or eighty days in the case of the equine fœtus. When the corrugations first appear in the surface of contact, they arise by the dipping of the rete Malpighii of the epidermis into the corium, and not by outgrowths of the corium into the epidermis, as has hitherto been held. The horny laminæ are the cornified cores of these epidermal ingrowths, and remain standing out from the inner surface of the wall of the hoof after the removal, by maceration or other artificial means, of the uncornified inner layers of the epidermis. The laminæ are simple at first, but secondary ridges soon develop upon the lateral surfaces. Professor Mettam also gives an account of the Pacinian and other corpuscles found in the sensitive frog of the foot, and the comparison which he draws between the histological structure of the sweat glands of the horse's frog and that of the interdigital glands of the sheep and the ceruminous glands of the external ear is interesting.

"International" Congresses.

The provisional programme of the International Congress of Psychology, to be held at Munich from August 4 to 7, has been issued. It gives the titles of 102 papers; more will follow. Shortly after this congress, the Fourth International Congress of Criminal Anthropology will be held at Geneva, August 25 to 29. Applications for membership should be sent to Mr. Maurice Bedot, Musée d'histoire naturelle, Geneva.

We have already drawn attention to the "International Congress of Miners and Geologists," to be held at Buda-Pesth at the end of September next. We now find that a congress with the still more imposing title, "The Fourth International Hydrological, Climatological, and Geological Congress," is to be held at Clermont-Ferraud about the same time. Needless to remark that neither of these meetings have anything to do with the International Mining Congress, recently held at Aix-la-Chapelle, or with the "Congrès géologique internationale," nor have any geologists of our acquaintance been invited to either of them. An international congress, conducted in the usual manner, is at its best a lop-sided affair, since the indigenous representatives are always in an overwhelming majority, while the people who really care about the subjects discussed curiously contrive to withhold both their persons and their sympathy, leaving some magniloquent motion intended to revolutionise the universe to be carried by an unintelligible enthusiast in a bare quorum of somnolent sufferers. But when it comes to two international congresses on the same subject, meeting at the same time, we should say the term "international" was about played out, even as an advertisement.

The Zoological Society's Report.

The Report presented to the sixty-seventh Anniversary Meeting of the Zoological Society of London is a highly satisfactory document. There is a considerable increase in the number of Fellows, no less than 197 joining the Society in 1895, the largest number elected since 1877. Professor Christopher Aurivillius, of Stockholm, and Professor Max Weber, of Amsterdam, have been elected Foreign Members, and Messrs. E. Büchner, J. E. Matcham, R. R. Mole, A. J. North, T. E. C. Remington, F. E. Schulze, and Alfred Sharpe, Corresponding Members. The fine weather and the acquisition of a giraffe increased the receipts for admission to the Gardens by £1,333, and a proportionate increase is also shown in the riding fees and in the refreshment department. Among the more interesting sources of income are admissions, £15,639; rides, £762; rent for refreshment rooms, £975. Of expenditure the following are of interest: Provisions, £3,558; animals, £1,541; menagerie expenses, £3,349. Something like £700 was saved by the low price of hay and other fodder during the year, and the bulk of this sum was expended in new animals. The extra-

ordinary expenditure consisted of £500 for the giraffe, and £1,149 for drainage works. This latter sum was spent in settling the long-vexed question of the drainage into the Regent's Canal. The Gardens now drain straight into the new Gloucester Gate sewer, and the trouble of the past fifty years has been brought to a termination, satisfactory at once to the vestries of St. Marylebone, St. Pancras, the Directors of the Canal Company, and, most important of all, to the inhabitants of the neighbourhood. About one hundred persons are employed in the care and maintenance of the menagerie and Gardens, and the public will miss the popular keeper of the lions, Seth Sutton, who has been pensioned off after nearly forty years' service. 665,326 persons visited the Gardens during 1895. The last £1,000 due on the mortgage debt has now been paid off, and the Society's freehold premises, valued at £25,000, are free and unencumbered. There is also a sum of £2,000 on deposit, and out of this we are promised a new house for ostriches and cranes.

In view of the great educational work carried on by the Zoological Society through their Gardens, and the general public interest in animals at the present time, as evidenced by the fact that no less than three popular monthly Natural Histories are now publishing, we reprint the following list of provisions purchased by the Society for the animals during 1895:—

Clover Hay ..	113¼ loads	Maw Seed ..	28 cwt.	Onions ..	3 bushels
Meadow Hay	131 ,,	Buckwheat ..	6 qrs.	Watercress ..	3,436 bunches
Oats	144 qrs.	Ground Nuts ..	29 cwt.	Nuts ..	33½ pecks
Wheat ..	43½ ,,	Barley Meal ..	3 ,,	Lettuce ..	229 doz.
Maize	70 ,,	Oatmeal ..	2 ,,	Apples ..	138 bushels
Bran	350 ,,	Milk ..	5,120 qts.	Pears ..	2½ ,,
Canary ..	15 ,,	Eggs ..	23,954	Grapes ..	1,156 lbs.
Hemp ..	11¾ ,,	Horses	200	Dates ..	1,395 ,,
Rape	1 ,,	Goats	197	Oranges ..	169 hundred
Millet	3¾ ,,	Flounders	2,184 lbs.	Carrots ..	132 cwt.
Barley ..	28½ ,,	Whiting	26,520 ,,	Potatoes ..	59 ,,
Bread ..	5,515 qtns.	Shrimps	1,252 qts.	Cherries ..	9 boxes
Biscuits ..	302 cwts.	Fowl-heads	7,512	Marrows ..	35 doz.
Rice	78 ,,	Rough Fish	9,667 lbs.	Bananas ..	1,149 ,,
Oilcake ..	56 ,,	Greens	37 bush.	Melons ..	50
		Cabbage ..	260 doz.		

The Royal Horticultural Society's Show.

As a brilliant spectacle, the Royal Horticultural Society's Show at the Temple Gardens was an undoubted success. The Society did not send us a ticket, but we were present on the opening day. We hope that the number and apparent splendour of the visitors resulted in an equally splendid financial success, and the desired "influx of new members, animated by the single desire . . . of improving and advancing the best and legitimate interests of all branches of gardening." Since its foundation in 1804, much useful work has been done by the Society. Besides experimental cultivation for the improvement of varieties of flowers and fruits, carried on continuously at Chiswick, many plants have been introduced from abroad. Don,

Douglas, Fortune, names familiar to botanists if only from their frequent commemoration in generic or specific names, were only three of the Society's most zealous and successful collectors. Don collected extensively on the West Coast of Africa, and afterwards in South America and the West Indies. To Douglas, who visited North America, and especially the Pacific coast, we owe the introduction of many conifers—the Douglas Pine (*Pseudo-Tsuga Douglasii*) from British Columbia, *Pinus Lambertiana*, *P. insignis*, *P. ponderosa*, and others; among shrubs the familiar flowering currant, and many well-known garden flowers besides—Gilias, Clarkias, Godetias, lupines, Eschscholtzias, etc. To Fortune, who went to China in 1842, we owe the "Chusan Daisy," the parent of our Pompon chrysanthemums; the Japanese anemone, *Weigelia*, and that pretty spring flower the *Dielytra*. Fortune also made careful observations on tea cultivation, and subsequently entering the East India Company's service, by his experiments in the north-west provinces of India, laid the foundation of the tea-growing industry in India and Ceylon. John Reeves, who had visited China more than twenty years before, sent home the beautiful *Wistaria sinensis*, of which the original plant is still growing in the Society's garden at Chiswick.

We cannot enumerate the glories of the Temple Show. There were quaintly marked tulips, glaring begonias, soft-coloured carnations, and a bewilderingly bright bank of orchids—one lady thought "there was something almost spiritual" about the latter. But the prettiest thing, in our opinion, was a little Alpine garden arranged by Backhouse, of York. In spite of the fact that plants were rather mixed, the Californian *Darlingtonia* and *Calochortus* with European gentians, it looked like a little bit of nature that had got in by mistake.

Henry Woodward on Crustacea.

In Dr. Henry Woodward's Presidential Address to the Geological Society, a vast amount of learning is compressed into the twenty-eight pages which deal with the "Life-history of the Crustacea in later Palæozoic and in Neozoic times." Those at all new to the subject will be astonished at the wealth of genera and species now known of fossil Malacostraca, and at the distant dates to which the familiar groups of crabs and crayfishes, of shrimps and woodlice, can be traced back. In the period of the Greensand, an isopod, resembling the well-known *Bopyrus* now living, had already learned to take up its lodging free of rent in the carapace of a prawn. The well-tasting *Squilla mantis* of the Mediterranean has its recognisable ancestry in the Coal Measures, in the Chalk, in the London Clay. The palæontology of Crustacea, as it is more and more investigated, promises to be full of instruction in regard to the slow, the far-stretching, the complicated evolution of life. Unfortunately the fossil remains of this class are often very obscure in many of the details that would seem

most instructive. That such remains are not more abundant may be thought surprising, considering how prolific most crustaceans prove themselves to be, and that they frequently shed their entire integument. The reason for the scarcity may be found in the fact that they are a food so very acceptable in the animal kingdom, and that even the cast shells are devoured, either by their late owners or by other creatures.

In complimenting the vigorous official activity of some aged American geologists, Dr. Woodward makes pathetic allusion to a rule in our own Civil Service which shows scanty respect to age, for at a definite date "Comes the blind Fury with the abhorred shears and slits the thin-spun life." Free countries are ever famous for logical consistency. That is why we in England consider that prime ministers, archbishops, lord chancellors, are at the zenith of their powers at sixty-five, while at that age we think it proper to dismiss from office the geologist, the botanist, the palæontologist, as though the mystic date on a sudden turned into foolishness and flaccidity all their ripe experience, their stores of knowledge, their energy, their judgment and acumen.

AN ANCIENT OCTOPOD.

A VERY remarkable and beautiful fossil has been recently dug out of the alluvium in the Museum of the Geological Society, London, and figured and described by Dr. H. Woodward in the May number of its *Quarterly Journal*. It is no less than a complete octopus from the Cretaceous beds of the Lebanon. Collected in 1842 by T. J. Newbold, it was named in manuscript by J. de C. Sowerby in 1846, and referred to in 1877 by Louis Lartet, since which time it has been again buried and lost till rediscovered a few months ago. The octopus, which bears Sowerby's name *Calais newboldi*, shows its eight arms, each furnished with suckers, the umbrella or web, beaks, funnel, fins, and ink-bag, and is in a singular state of preservation. The fins which are triangular, one on either side of the body, and not united behind, form the diagnostic character of the genus, and their wing-like appearance has suggested its name, for Calais was one of the winged sons of Boreas. The specimen is the oldest known representative of this division of the Cephalopoda.

I.

How and Why Scorpions Hiss.

TO many residents in India, especially to those interested in natural history, it is possibly a well-known fact that the large black scorpions of that country will frequently emit distinctly audible sounds under the stimulus of fear or of anger. Possibly, indeed, the circumstance has been regarded as so well known that few have considered it as deserving of special mention. For example, in the following passages, published in *Nature*, in 1879, in connection with the suicide of scorpions, the observer is evidently unaware of the interest attaching to the words that we have italicised. After describing how he procured a specimen of "the common black scorpion of Southern India" [doubtless *Scorpio fulvipes*], and placed it for safety "into a glazed entomological case," Mr. W. G. Bidie says . . . "taking a common botanical lens I focussed the rays of the sun on its back. The moment this was done it began to run hurriedly about the case, *hissing and spitting in a very fierce way*. This experiment was repeated some four or five times with like results, but on trying it once again the scorpion turned up its tail and plunged the sting, quick as lightning, into its own back." It will be noticed that the "hissing and spitting" of the scorpion are here referred to quite incidentally, and are merely thrown in as an item of "corroborative detail, to give artistic verisimilitude to the narrative"; and it may be safely assumed that the observation would never have been recorded in this case had it not been for its intimate connection with the fancied self-destruction of the chief actor in the tragedy described.

This little anecdote has been quoted, not because it is the first record of the 'hissing' powers of the Indian scorpions, but because it affords an illustration of the possibility of the fact being a matter of common knowledge to many of those who had fallen in with these animals in the Oriental Region prior to 1877. Possibly, indeed, the occurrence had been noticed in print before that date; but Professor Wood-Mason evidently believed the fact to be new to science when he read a paper on the "Stridulation of Scorpions," before the Entomological Society of London in September of that year. At all events, there is no reason to suppose that the organ by which the 'hissing' is produced had been previously discovered or described; and as a tribute to the acumen of this naturalist it may be added that

he found the organ and foretold its function before he was aware of the ability of scorpions to emit special sounds of any kind. An opportunity of verifying this prediction first presented itself at Bombay, when he was on his home journey from Calcutta. Here he procured two black scorpions, and, placing them face to face on a small metal table, goaded them into fury, whereupon they immediately began to beat the air with their great pincers and simultaneously to emit sounds, which were distinctly audible to the bystanders, and "resembled the noise produced by continuously scraping a piece of silk-woven fabric, or, better still, a stiff tooth-brush, with one's finger nails." In another place the sound is said to be "almost as loud as, and very closely similar to, that made by briskly and continuously drawing the tip of the index finger backwards and forwards in a direction transverse to its coarse edges over the ends of the teeth of a very fine-toothed comb." And, finally, in describing the situation and structure of the organ which produces the sound, Wood-Mason says: "The apparatus is situated —the *scraper* upon the flat outer face of the basal joint [segment] of the palp-fingers; the *rasp* on the equally flat and produced inner face of the corresponding joint of the first pair of legs. On separating these appendages from one another a slightly raised and well-defined large oval area of lighter coloration than the surrounding chitine is to be seen at the very base of the basal joint of each; these areas constitute respectively the *scraper* and the *rasp*. The former is tolerably thickly, but regularly, beset with stout conical sharp spinules, curved like a tiger's canine, only more towards the points, some of which terminate in a long limp hair; the latter crowdedly studded with minute tubercles, shaped like the tops of mushrooms."

It is a pity that this brief preliminary account was never followed by a more detailed and illustrated description of the organ in question at the hands of its original discoverer. But since death has now unhappily rendered this an impossibility, it is undesirable that there should be any further delay in figuring this remarkable instrument, and in publishing a short explanation of certain points in its structure which do not appear in the account cited above. In the first place, however, for the sake of those readers of NATURAL SCIENCE who are not familiar with the details of a scorpion's anatomy, it is proposed to add a few lines on this subject so as to make clear to all the mechanism and structure both of Wood-Mason's organ and of two others that have recently been discovered in some African species, but hitherto neither figured nor described.

Attached to the cephalothorax, or forepart, of a scorpion's body, are six pairs of appendages, four of which on each side are set apart for locomotion, and constitute the legs properly so called. The basal segments or coxæ of these legs are welded together and closely in contact, so as to be capable of but little movement. But immediately in front of the first leg there is a large and powerful limb variously

known as the chela, pincer, or palp (the palp-finger of Wood-Mason), which is used for seizing and holding prey, and is for this reason loosely jointed to the body, and capable of extensive movements, up and down and from right to left; and since the hinder surface of its basal segment is closely applied to the front or adjacent surface of the corresponding segment of the first leg, it necessarily slides over it when the pincer is in motion. In this spot, therefore, the conditions for the production of a stridulating organ are most favourable, for, as was explained in the article entitled "Musical Boxes in Spiders" (NAT. SCI., vol. vi., p. 44, Jan. 1895), sound-producing organs in the vast majority of Arthropoda are developed exclusively where friction occurs between two adjacent chitinous areas. In addition, however, to the great pincers, all scorpions possess a second pair of highly-mobile appendages. These are the mandibles or chelicerae, which

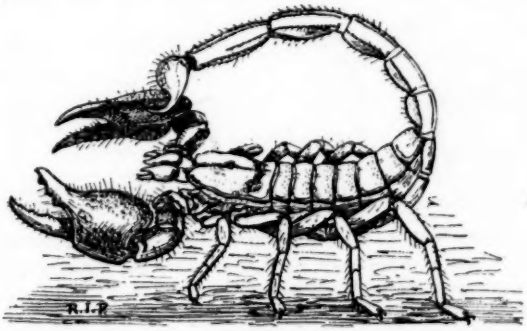

FIG. 1.—INDIAN SCORPION (*Scorpio swammerdami*) STRIDULATING; two-thirds natural size.

have the form of small three-jointed pincers, lodged beneath the front margin of the carapace or head-shield, and capable, like the chelae, of considerable movement in all directions, and especially of extension and retraction in a line with the long axis of the body. When moved in this way the inner surface of the one can be rubbed against the inner surface of the other, and the upper surface of both against the anterior edge of the carapace. It is here that the new compound organ to be described has been developed in the large S. African scorpions of the genus *Opisthophthalmus*.

Returning, however, for the moment to Wood-Mason's organ: As has been explained, this exists between the basal segments of the first leg and of the chela, and may easily be detected by the naked eye when these two appendages are pulled apart from each other. The keys or notes (the scraper of Wood-Mason) occupy the yellow area on the coxa of the chela (*see* Fig. 2, A), and, as in the case of the large so-called *Mygale* spiders, they are simply modified hairs, as may be clearly seen by examining those situated close to the edge of the area in question. Here the hairs are simply thickened and

compressed at the base, the remaining part being normally slender, though sometimes slightly curved; but in the fully formed notes the distal part of the bristle is bent at right angles to the basal part, which is enormously expanded and flattened from side to side (*see* Fig. 2, C and D). Here and there amongst the notes rises a normal bristle, showing that all the hairs, presumably to allow free room for vibration, have not become involved in the formation of the instrument. It may also be noticed from the figure that the ends of the hairs are bent in the same direction and keep clear of each other. Their appearance, indeed, reminds one forcibly of a number of weathercocks or streamers before a stiff breeze, or of the heads of a crowd of stork-like birds all gazing in the same direction. When the chelæ are waved up and down, the tips of these notes catch against the roughness of the contiguous area on the basal segment of the first leg (Fig. 2, B), and, being thrown by this means into a state of

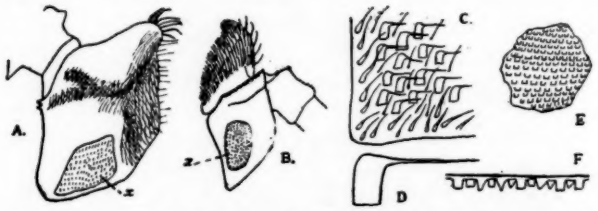

FIG. 2.—STRIDULATING ORGAN OF INDIAN SCORPION, *Scorpio swammerdami*.

A, Coxa of pincer, with key-board *x*. B, Coxa of first leg, with rasp *z*. C, Portion of key-board, showing notes. D, one of the notes. E, Diagram of portion of rasp, showing papillæ. F, Diagram of papillæ in side view.

vibration, produce the hissing or rustling sound that has been described. The roughness, when examined under an inch objective, appears to consist of a thick cluster of granules, but these when more highly magnified take the form of irregularly arranged, variously sized papillæ, shaped somewhat like a human incisor tooth (*see* Fig. 2, E and F). It should be added that the figures and descriptions here published are taken from an example of the largest-known Indian scorpion, *Scorpio swammerdami*. Probably the specimen examined by Wood-Mason—"a gigantic one from the Upper Godaveri District"—was also a representative of this species. But this is not certain, nor is it of any special importance, seeing that the organ is found in all the Oriental species of *Scorpio* ranging from Bombay to Borneo.

Curiously enough, however, in the species usually referred to the same genus inhabiting tropical Africa an analogous organ exists, which, although agreeing with the one just described in structure and, broadly speaking, in situation, yet differs both in the arrangement of its parts and in exact position, and has evidently originated entirely independently of the other in response to the stimulus of similar needs. Like the organ discovered by Wood-Mason, this new one is

lodged between the basal segments of the pincers and of the first pair of legs. No doubt, too, a rustling sound is produced by the waving of the pincers and the consequent friction between the adjacent surfaces of these two segments. But in this case the notes or keys are situated upon the base of the first leg (Fig. 3, A) and the scraper upon the base of the pincer (Fig. 3, B). The arrangement is, consequently, exactly the opposite of that which obtains in Wood-Mason's instrument. The position, moreover, of the stridulating areas upon the respective segments is also different, the area upon the coxa of the first leg being situated, not upon the main part of the segment, but upon its maxillary process (*see* Fig. 3, B), and that upon the coxa of the pincer being moved a corresponding distance to the front (Fig. 3, A). The latter is thickly studded with minute spicules, and the former much more sparsely with notes, smaller than those that occur in the Indian species, but like them in origin and essential structure, being evidently nothing but hairs expanded at the base and bent over at the distal end. The form of these notes in the West African *Scorpio*

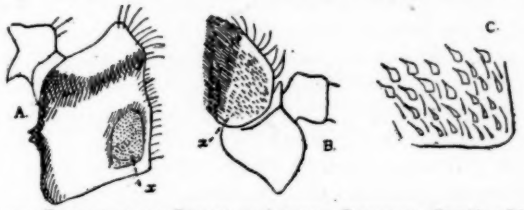

FIG. 3.—STRIDULATING ORGAN OF AFRICAN SCORPION, *Scorpio africanus*.

A, Coxa of pincer with rasp, *x*. B, Coxa of first leg with keyboard, *z*, on its maxillary process. C, Portion of keyboard enlarged to show the notes.

africanus is shown in Fig. 3, C, but in some of the other species the terminal part is longer and thinner.

The scorpions possessing this organ are distributed in equatorial Africa from Senegambia to the Congo on the west, and from Abyssinia and Somaliland to Lake Nyassa on the east. The Saharan region to the north of this area is occupied by the allied genus *Heterometrus*; but in this form no stridulator has been detected. Ranging, however, over the whole of S. Africa to the south of the area occupied by *Scorpio*, occurs the genus *Opisthophthalmus*, of which most of the species possess a well-developed sound-producing organ totally different both in structure and position from those that have hitherto been discussed. The discovery of this organ was due to a lucky chance. In the course of a correspondence with Mr. G. A. K. Marshall, who has spent some years both in Natal and in Mashunaland, and has proved a most valued contributor to the national collection, my interest was aroused by some casual remark of his touching the stridulation of *Solpuga* and of scorpions, and, in reply to a question on the latter point, he wrote as follows:—"With reference to your inquiry as to the 'hissing' of scorpions, I have often heard

this myself. Indeed, only three days ago, while walking into Salisbury from the Umfuli, I met one in the road which hissed at me on my approach. I watched to see from what part the sound proceeded, and it appeared to me to be caused by the movement of the mandibles alternately backwards and forwards. I did not catch the specimen, since it belonged to the species of which examples have already been sent to you—in fact, the only one that I have seen round Salisbury. I have also heard the common small black scorpion of Natal make a similar noise, and this is a generally well-known fact there. I have never examined a dead scorpion to find the stridulating organ, but from the action of the living creatures I presume it is very similar to that of *Solpuga*. The sound of the latter is, however, much harsher and more grating than that of the scorpion, which is best described as hissing."

An examination of the mandible of the species referred to—*Opisthophthalmus glabrifrons*—not only showed very clearly the position and structure of the sounding organ, but also furnished an explanation of the difference in tone between the stridulation of *Solpuga* and of this scorpion. In the former, as is well known, the harsh grating noise is produced by the friction of a set of hard coarse ridges, situated on the inner surface of the mandible of one side, against an exactly similar set upon the corresponding surface of the mandible of the other side. In position the organ of *Opisthophthalmus* resembles that of *Solpuga*, being situated upon the inner surface of the basal segment of the mandible, and a further resemblance lies in the fact that the part of the instrument on the right mandible is structurally similar to that upon the left. In this respect the instrument, as a whole, is quite different from the analogous instruments found in the species of *Scorpio* and in the stridulating spiders of the family Avicularidæ, where two distinct structures, namely strikers and notes, are involved in the composition of the instrument.

A glance at the annexed figures will show that the organ in question consists of a set of delicate membranous notes, projecting upwards from near the middle of the inner surface of the basal segment (Fig. 4, A). In different species they vary, both in number and form, being sometimes racket-shaped, with a long stalk (Fig. 4, D), and sometimes heart-shaped, with scarcely any stalk at all (Fig. 4, E). The latter kind is found in *O. granifrons*, the former in *O. carinatus* and *O. nitidiceps*, while notes of an intermediate type occur in *O. glabrifrons* (Fig. 4, C). The number also varies in different species, and apparently in different members of the same species. For example, a specimen of *O. carinatus* from Otjimbinque has as many as eight (Fig. 4, B) on each mandible, while a second from the Umfuli River in Mashunaland possesses but five. Again, six were noticed in a specimen of *O. latimanus*, four in *O. pugnax* and *O. capensis*, three in *O. breviceps* and *O. glabrifrons*. But the exact systematic value of this new character has yet to be determined. Apart from the distinctive

features pointed out, the notes in all the specimens examined are alike, being thin, flat, leaf-like, and finely striate. The edges, when entire, are evenly convex, though not infrequently they present a ragged appearance as if frayed from rough usage. That these notes are nothing but modified bristles there can be little doubt, though since they now occupy an isolated area practically free from hairs, the direct evidence of their origin is not so clear as it is in the analogous cases presented by the species of *Scorpio* and by the mygalomorphous spiders.

Of all the species of *Opisthophthalmus* contained in the British Museum two only, namely *O. wahlbergi* and *O. pallidimanus*, show no traces of this instrument. But in these, as in the other species of the genus, the upper surface of the basal segment of the mandible is raised at its distal end into a prominence thickly studded with bristles (Fig. 4, A and B); and when examined under a high power these bristles may be seen to be modified in exactly the same way as

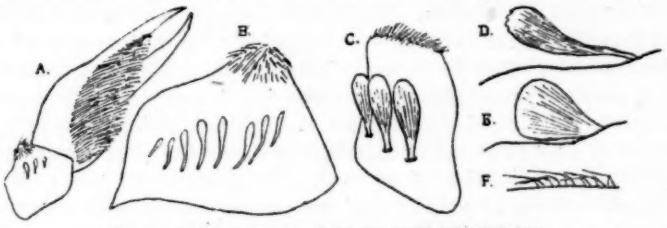

FIG. 4.—STRIDULATING ORGANS OF *Opisthophthalmus*.

A, Inner surface of mandible of *O. glabrifrons*, with three notes and bristly prominence on the basal segment. B, Basal segment, with notes and bristly prominence, in *O. carinatus*. C, Keyboard of *O. glabrifrons*. D, One of the notes of *O. carinatus*. E, One of the notes of *O. granifrons*. F, Some of the notes from the tuft of bristles of *O. capensis*.

are those that constitute the notes in the species of *Scorpio*—that is to say, the base is thickened and compressed, while the slender terminal portion is bent over at right angles as represented in Fig. 4, F. From what is known of the function of the similarly-constructed bristles in *Scorpio swammerdami*, for instance, it cannot reasonably be doubted that these bristles subserve the same purpose of producing sound in *Opisthophthalmus*, and in the absence of any specially-constructed scraper we may conclude that they are thrown into a state of vibration by scraping against the front edge of the carapace, as the mandible is forcibly withdrawn beneath it. There are thus two distinct stridulating organs within the limits of this genus. In some of the species, indeed, the two organs exist side by side, as may easily be seen by examining the mandible of *O. capensis*, the species that occurs abundantly in the vicinity of Cape Town.

Apart from this new organ, the most interesting feature connected with *Opisthophthalmus* is the characteristic from which the genus derives its name, namely, the backward position of the median

eyes on the carapace. The cause of their migration from the middle of this plate has never been explained, but it is possibly connected with the peculiar habit of rubbing the mandibles backwards and forwards to produce the stridulation, the end in view, if the expression may be pardoned, being the keeping of the ocular nerves clear of the retractor muscles, which normally pass on each side of them towards the hinder portion of the cephalothorax.

Since the possible utility of the stridulating instruments in spiders has been recently discussed in some detail in the pages of NATURAL SCIENCE, it is unnecessary to do more than briefly touch upon the same topic in connection with scorpions. Suffice it, then, to say that since the organs that have been here described are equally well developed in both males and females, and appear in the young long before the attainment of maturity, there is no reason to suppose that they are of a sexual nature, serving, like the chirrup of the cricket or the call of the cuckoo, to inform the one sex of the whereabouts of the other. If this were the case, we should expect to find, firstly, that the organs were exclusively confined to one sex, or, at all events, better developed in it than in the other; and, secondly, that they put in an appearance either just before or simultaneously with the reaching of the adult stage. Again, in spite of the opinion of many authorities, who maintain that the existence of a sound-producing organ implies of necessity the existence of an auditory apparatus in the same individual, we can only assert again that there is not a particle of evidence that either the large spiders or the scorpions can hear the sounds that their own stridulating organs emit. All the available evidence goes to show that in these groups of arachnids the organ is brought into use when its possessor is under the influence of irritation or fright, exactly as in the case of the rattlesnake's rattle. Like the snake, too, both the scorpions and the spiders are furnished with highly-developed poison-glands, and it is a well-known fact in natural history that animals so gifted are frequently rendered conspicuous by bright and staring colours, so that they may not be destroyed by carnivorous creatures in mistake for other harmless and edible species. Nature, in fact, for purposes of protection, has labelled them with her poison-badge; and, apparently with the same end in view, she has supplied the rattlesnake and the large spiders and scorpions with a sound-producing apparatus, which, when in action, serves as a danger signal to meddlesome intruders, warning them to beware of hostile interference. But if, as has been suggested, it is the function of these interesting organs to act in this manner as an advertisement of the whereabouts and nature of the species that possess them, it is surely clear that their existence implies the existence of an auditory sense, not necessarily at all in the performers themselves, but only in the enemies that might otherwise destroy them. In exactly the same way it is absolutely unnecessary, and indeed impossible, for the katipo (*Lathrodectus scelio*),

the little black poisonous spider of Australasia, to see the scarlet badge on its back, or the cobra the pattern on its hood, in spite of the fact that from the existence of these marks the existence of eyes to see them is to be inferred.

In conclusion, however, it must not be forgotten that the explanation here given of the probable function of the stridulating organs in the large spiders and scorpions is at present unsupported by any direct observations as to the protective effect of the sound. As a matter of fact, as Mr. Marshall informs me, the species of *Opisthophthalmus* are eaten in spite of their hissing by both baboons and roller-birds. But so also is the cobra killed by the mungoose, notwithstanding its poison-badge, and bees are devoured by frogs and toads, though decked with warning colours. Within the limits, indeed, of the animal kingdom it would probably be impossible to find a single instance of a protective feature serving to save its owner from the attacks of enemies of all kinds. The hypothesis, therefore, that the sound, like the scarlet band on the katipo, acts as a danger-signal need not be rejected on the grounds that monkeys which are partial to a diet of scorpions, and skilful enough to handle them without damage, pay no heed to the hissing when searching beneath stones for these animals and other vermin; and since the hypothesis affords both a simple and plausible explanation of the phenomenon, it may be provisionally adopted as a probable approximation to the truth, at all events until reasons can be shown for thinking that it is logically untenable, or until another and a better one is put forward in its place.

R. I. Pocock.

II.

An Introduction to the Study of Anthropoid Apes.—I. The Gorilla.

IT is possible that the recent addition of a young female gorilla to the Gardens of the Zoological Society of London may lead to a renewed interest in this bulkiest of Primates in the minds of many people; and if the interest aroused be sufficient to induce some of these to become better acquainted with the history of this alleged cousin of the human race, they will find it can be read only by picking their way through the European periodical and academical scientific literature of the last fifty years. Having been working at the anatomy of the higher Primates for a number of years past, and having in that time become acquainted with the better part of the literature dealing with this animal, it occurred to me that a short article, to act not only as a guide to work already done, but also as an index to the lines of future effort, might prove useful to some at the present time.

The Gorilla in Confinement.—Before getting well into the subject in hand, however, it would be better to dispose of what we know of the gorilla as a visitor to Europe. The example now in the Zoological Gardens is the third of its kind that has lived in England; its predecessor died after a short stay in the Gardens (*Proc. Zool. Soc.*, 1887, p. 559). The first gorilla came about 1860, and spent seven months in a menagerie in the north of England; its skin and bones are said now to rest in Ushaw College, Durham. It had the misfortune to be shown as a chimpanzee. In *Proc. Zool. Soc.*, 1877, p. 303, a fine drawing of it by Wolff is given. There have been at least five living gorillas in Germany. Four belonged to the Berlin Aquarium; Falkenstein's, which cost £1,000, lived there for fourteen months, and had been in confinement for over three years; Hermes' example lived two months, but was said to have been in the possession of a native chief for over six years; the other two lived for very short periods (25, 43, and 47). One lived for a short time in Paris (60). It will be seen that confinement in Europe is quickly fatal to the gorilla; this probably depends less upon the climate than upon its temperament, which is fierce, intolerant of bonds, and lacking the docility of the easily-confined chimpanzee.

Biological Beliefs, Methods, and Ends.—Scientific literature is becoming so bulky and unwieldy, with every prospect of becoming even more so, that it is of the utmost importance to come to some understanding as to the aim and end of such a study as that of the gorilla, and as to the methods by which the aim and end are to be attained. This is all the more necessary since our biological beliefs, our methods, our ultimate ends, are not those of the generations that have left the records with which we have now to deal. The creed, methods, and aims of the older anatomists were simple and primitive: they believed an individual could represent its race; the characters of any one average specimen were exactly the same as the characters of its species; their methods lay in the dissection and description of a certain type individual, with a commentary on its similarities and dissimilarities when compared with its neighbours. By a judicious grouping of similarities they sought to obtain a clear mental picture of the higher primates in their true perspective relationship, with man overtopping all and well apart from his anthropoid neighbours. In fact, this most laudable aim—the segregation of the human race—has occasioned the greater half of the research that has been done upon the anthropoids; the other half may be said to be due to museum-made strife over the number of gibbon, orang, and chimpanzee species. Hence the form in which we find the literature on the anthropoids—all more or less polemical. Now these creeds, aims, and methods are gone: they are dead as Bathybius. They have been gradually replaced by the tenets of a race of workers that refuse to accept one, two, or even five individuals, however selected, as fit to represent a species, as much as they deny the possibility of any one man embodying the characteristics of his nation. A species, they believe, can be represented in its full and absolute truth—were it possible—only by a dissection, description, and tabulation of every part of every living individual of that species. For example, if the individuals that make up the present living race of gorillas were superimposed muscle on muscle, artery on artery, brain-convolution on brain-convolution, the result would be, not the clear outline of a typical individual, but rather an amœboid form with a considerable amplitude of variation in certain well-defined directions. This newer mental picture of a species, then, is of an amœboid form with the lines of variation thrown out as pseudopodia, which may be regarded as feelers co-ordinating the race with its surroundings. Such a conception of the species by the modern biologist has necessarily led to a change in his methods. They are still, of course, dissection, description, and tabulation, though not of one, but of many individuals: few anatomists would accept less than one hundred individuals to represent a species. What is wanted first and most for the animal with which we are at present dealing is a thorough and minute dissection of one gorilla to act as a standard for future workers. There is only one description that nearly approximates to such a standard—Deniker's

(17); but, unfortunately, it is the dissection of a fœtal animal. Much of the work that has already been done, such as that of Owen and Hartmann, is almost useless for future purposes, as a list of the material used is never explicitly stated—the first essential—and only general statements are given. In short, Owen and his school may be said to have been anatomists of the individual; his successors were and are anatomical census-takers of the race.

The aim and end to which all such work as this should be directed is, I take it, to find out not only how the individual, but also how the race, moves, lives, and has its being; and any fact which helps towards this end deserves to be recorded. We wish to discover, also, how races have come into their present shapes and habits; how they are co-ordinated with their surroundings; and to what extent we may prophecy with truth as to how these races might be moulded in changed surroundings. Such studies pursued upon man's nearer neighbours ought to give some understanding of the methods by which he has attained his present form and position. But, besides these more philosophical problems, the solution of which leads only to a certain mental satisfaction, the anthropoids offer, in the simplicity of their mind and body, a clue to the more practical study of the elaborate psychology and physiology of man.

The Nervous System.—Seeing that the brain is regarded as the organ that keeps the individuals of the higher races sexually and socially congregated together in a group known as a species, and seeing further that the form of the brain is moulded by and dependent upon function, its study becomes of the first importance. About a dozen gorilla brains have been seen altogether: Bischoff (4, 5, 9), Broca (11), Chapman (14), Deniker (17, a fœtal brain), and Pansch (67) have given figures and descriptions of the convolutions; Féré (27), Gratiolet (32), Moeller (62), Thane (78), and Owen (66) have noted some points concerning it. As for the convolutions, we neither know their meaning nor what relationship they bear to function. They are probably of less value physiologically and morphologically than the basal parts of the brain, of the centres and tracts of which we know nothing. The cerebellum is still untouched. Waldeyer (85) has given us a splendid piece of research on the spinal cord, and Eisler's (24) account of the distribution of the nerves is very good. Hepburn (45) also gives a full account of the main nerves of the limbs. The microscopical structure and distribution of motor areas of the cortex of the brain are unknown.

The Muscles.—The muscles of the gorilla have been well described by Deniker (17) and Duvernoy (22); Hepburn (45) gives a full account of the muscles of the limbs. Partial descriptions have been given by Bischoff (7), Chapman (13), Chudzinski (16), Ehlers (23), Huxley (49*b*), Macalister (55), Ruge (70), Symington (76), and Wyman (87). As already pointed out, a standard dissection, to include at the same time the work already done, is still required.

The muscles ought to be treated in functional groups, their actions and nerve supplies being also noted.

Ligaments.—Ligaments have been described by Duvernoy, Deniker, Hartmann (39), and Macalister (55).

The Skull.—There are over 250 gorilla skulls in the museums of Europe and America. More or less partial records of over 100 of these are to be found in literature. Owen's descriptions are, perhaps, the best (64, 65, 66); others are given by Virchow (84), Bischoff (3 and 8), Deniker (17 and 18), Duvernoy (22), Giglioli (31), Halford (34), Hamy (35), Hartmann (40), Hervé (49), Török (80 and 81), Turner (83), and Wyman (87). Duckworth (20) has made an important contribution on the variations found in the gorilla skull. It may be safely said, by way of postscript to this list, that the skull has been the most sadly abused structure of the animal body. The present manner of description by angles and indices is a method that leads only to the accumulation of a mass of most useless, cumbersome material. The describers seem to have lost all sight of the skull as a functional organ, with its form adapted for its two main uses, as a brain cover and a tooth carrier. Its description, to be of use, must be given in relation to these two functions.

The Skeleton.—For a general description of the skeleton the text-books of Flower, Huxley, and Owen are still as good as any. More elaborate descriptions are given by Aeby (1), Deniker (17), Duvernoy (22), Halford (33), Hartmann (40 and 43), Heckel (44), and Mivart (61). Struthers has dealt with the variations in the vertebral column (74). Kneeland (50), Lucae (54), Slack (73), Swayne (75), and Wyman (87) have also made smaller contributions. From the elaborate and expensive lithographs of bones which are sometimes given with these papers, one would conclude either that the scientific societies had a superabundance of funds, which is unlikely, or that these lithographs are more permanent and convenient for reference than are the bones themselves. On the ossification and fixation of the epiphyses to the shafts nothing is known beyond Deniker's work.

The Teeth.—In the text-books of Tomes, Huxley, and Owen general descriptions of the teeth are given. Topinard has dealt with the cusps and fangs of the molars and premolars (82); Magitot (56 and 57) treats of the dentition of the gorilla. Duvernoy and Heckel also give a description of the teeth, while abnormalities are reported by Magitot (57), Gervais (*Journ. Zool.*, vol. iii., pp. 164–166; 1874), Bateson (*Proc. Zool. Soc.*, 1892), and in the *Trans. Odont. Soc.*, 1887, p. 266. Little is known of the dates at which the teeth cut the gum (*see* Famelart, 26).

The Alimentary System.—The mouth, tongue, and pharynx have been figured or described by Ehlers (23), Bischoff (7), Duvernoy (22), Chapman (13), and Deniker (17). The viscera of the abdomen have never been thoroughly described. The liver has been dealt

with by Chudzinski (15), Flower (28), Virchow (84), Deniker (17), Bolau (10), Bischoff (7), and Huxley (49*b*). The alimentary canal has been observed, though only in a cursory manner, by Virchow (84), Deniker (17), Chapman (13), Bischoff (7), Bolau (10), Flower (28), and Hartmann (40). Macalister and Deniker mention the presence of salivary glands (!) But of the pancreas, the supra-renal bodies, the arrangement of the peritoneum and mesenteries, and the sympathetic system of the abdomen, we know practically nothing.

The Respiratory System.—A great deal has been written on the larynx and laryngeal sacs: Ehlers (23), Deniker (17 and 19), Bischoff (7), Duvernoy (22). The function of these sacs is unknown. The lungs are partially described by Ehlers, Bolau, Bischoff, Deniker, and Hartmann.

The Circulatory System.—One would scarcely expect to find any peculiar feature about the heart of the gorilla, and none has been recorded, yet one would expect that the disposition of the pericardium and its relationship to the diaphragm would be different from that found in man. Only Bolau, Deniker, Ehlers, and Bischoff make mention of the heart. Our knowledge of the arteries of the gorilla we owe to Deniker (17) and Eisler (24). This system, especially as regards the veins, requires much more attention.

The Lymphatic System and the Ductless Glands.—Of the lymphatic system nothing is known except in a most general way. The spleen has been figured by Bischoff (7) and Deniker; Virchow (84) alludes to it; so does Bolau. Deniker and Ehlers give a short description of the thyroid; the thymus, supra-renal bodies, pineal and pituitary bodies, the carotid, and coccygeal bodies have never been described.

The Genito-Urinary System.—The kidney of the gorilla, like that of the other anthropoids, has only one papilla, and has been described by Deniker (17), Virchow (84), Bolau (10), and Ehlers (23). Its microscopic structure and development require to be investigated. The bladder and its relationship to the pelvis and pelvic fascia have not been noted. The testicle is cursorily described by Ehlers and Chapman, but the prostate and the urethra have not been examined. Duvernoy, Ehlers, Huxley (49*b*), Owen (*Proc. Zool. Soc.*, 1859), and Chapman have described the external genital organs. The reproductive system of the female requires examination, although Bischoff (6), Deniker, Bolau, Ehlers, and Hartmann (42) have already made contributions to this subject.

Organs of Sense.—These are not likely to show any marked differences from those of man; yet it would be well to give them the attention they have not yet received.

External Characters, Configuration, and Proportions.—Pigeon-holing systematists have devoted most of their attention to this aspect of the gorilla, so that a great part of literature is devoted to these more superficial and accessible characters. Very good

figures of the gorilla are given by Hartmann (40), by Wolff (*Proc. Zool. Soc.*, 1877), Bolau (10), Chapman (13), Deniker (17), Du Chaillu (21), Falkenstein (25), Lenz (53), Meyer (58), and Owen (66). The ear has been figured by Deniker, Ehlers, Bischoff, Hartmann, Owen, Lenz, and Bolau. The hands and feet have been dealt with by Hepburn (46), Chapman, Hartmann, Deniker, Bolau, Owen, Huxley (49*a*), Lucae (54), and Hermes. There was a silly question once raised whether the lower extremities were furnished with hands or feet; an index to the literature on the question is obtainable from Huxley's and Lucae's articles. The hair and its changes with age, as well as the pigment of the skin, and the method of its appearance and manner in which it is deposited and spread over the body, require some more observation, notwithstanding the elaborate descriptions of Lenz (53), Alix (2), Bischoff (7), Bolau (10), Chapman (13), Deniker (17), Du Chaillu (21), Ehlers (23), Famelart (26), Hartmann (40), Hermes (47), Meyer (58), Owen (66), Savage (71), and Wyman (87). Measurements are given by Bischoff, Hartmann, Bolau, Hermes, Deniker, Meyer, Owen, Chapman, Huxley (49*a*), and many others, but the subject and records are both alike unsatisfactory.

Psychology.—The intellectual and emotional characters of the gorilla have not been studied so much as even the few opportunities have allowed. Hermes gives the best description of its habits in captivity, and our knowledge of its habits in its native haunts is due for the most part to Du Chaillu. For the great amount of material, and the knowledge of the gorilla which he brought home, Du Chaillu had little in return but malaria, quinine, and scientific abuse, so that we need hardly be astonished that he has not pursued the subject further. The best *resumé* of the habits of the gorilla is still that by Huxley (49*a*), although further information may be picked from the accounts of Falkenstein (25), Famelart (26), Franquet (30), Ford (29), Hartmann (43), Laboullay (51), de Langle (52), Reade (68), Reading (69), Savage (71), and Walker (86).

Distribution.—The gorilla is confined to the French and German territories north of the Congo: *see* Hartmann (43), Savage (71), Reade (68), Reading (69), Ford (29), St. Hilaire (72), and Famelart (26). The extent of its distribution eastwards is unknown.

Classification.—Of all the literature on the gorilla this part of it is most marked by incompetence and prejudice. Luckily, Savage, the scientific discoverer of the gorilla, had Wyman to advise him, and they named it *Troglodytes gorilla*—regarding it as a large, sensual and ferocious form of chimpanzee. That seems to me the true and permanent scientific name and estimation of the gorilla. Duvernoy, however, called it *Gorilla tschego*, Is. Geof. St. Hilaire gave the name *Gorilla gina*, and now we have seen over the gorilla's cage at the Zoological Gardens the name *Anthropopithecus gorilla*; who the sponsor is for this appellation, we do not know. The close relationship

that exists between the gorilla and the chimpanzee came out very clearly in the famous dispute over "Mafuca." Mafuca was an animal in the Dresden Gardens labelled chimpanzee; Nissle (63) saw her and said she was a gorilla; Meyer, of Dresden, maintained she was a chimpanzee; Hartmann came from Berlin and declared her to be a gorilla; Bolau came from Hamburg and certified her to be a chimpanzee. The difference between the gorilla and the chimpanzee cannot be so very great when four such authorities cannot make up their minds in common. Koppenfels (59) accounted for the difficulty of distinguishing between the two by alleging that hybrids occur (a fact which I should not be astonished to find substantiated), and sent a skin and skull of such a supposed hybrid home from Africa to Meyer, who, however, did not agree that it was a hybrid. Local varieties will probably be found to occur; such seem to be the specimens described by Alix and Bouvier (2) under the name of *Gorilla mayema*. There may be distinct species of gorilla; but the specific characters ascribed by Alix and Bouvier to *Gorilla mayema* may be due to age, sex, individual, or local peculiarities of the two specimens described by them. At any rate, *G. mayema* cannot be accepted as a true species until it has been shown that the animals which possess its characters live, socially and sexually, apart from the common form of gorilla.

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2. **Alix, E., et Bouvier, A.**—"Sur un nouveau Anthropoide (*Gorilla Mayêma*) provenant de la région du Congo." *Bull. Soc. Zool. France*, 1877. t. ii., pp. 488–490. From an examination of a young female animal and the skin and skeleton of an adult female, they came to the conclusion that there were at least two species of gorillas—this one, *Gorilla mayema*, and the more common one, *G. gina* of I. G. St. Hilaire. Abstract in *Compt. Rend.*, 1878, t. lxxxvi. pp. 56–58.

3. **Bischoff, T. L. W.**—"Ueber die Verschiedenheit in der Schaedelbildung des Gorilla, Chimpanse und Orang, vorzüglich nach Geschlecht und Alter." München: 1867. 4to, 94 pp., 22. pls. The skulls of two old male, three old female, and three young animals are partially described.

4. ————————.—"Uber das Gehirn eines Gorilla und die untere oder dritte Stirnwindung des Affen." *SB. Math.-Phys. Cl. Ak. Wiss. München*, 1877. Bd. vii., pp. 96–139, 6 figs. Pansch and Thane describe the same brain.

5. ————————.—"Das Gorilla-Gehirn und die untere oder dritte Stirnwindung." *Morph. Jahrb.*, 1878. Bd. iv. Suppl., pp. 59–73. An argumentative article, the author being in doubts as to the brain described by Broca having really been a gorilla's brain.

6. ————————.—"Ueber die äusseren weiblichen Geschlechts-und Begattungs-Organe des Menschen und der Affen, etc." *Abh. Math.-Phys. Cl. Ak. Wiss. München*, 1880. Bd. xiii., Abth. ii., pp. 209–274. Three young gorillas were examined.

7. **Bischoff, T. L. W.**—"Beiträge zur Anatomie des Gorilla." *Tom. cit.*, 1880. Abth. iii., pp. 1–48. Figs. of tongue, palate, larynx, heart, and abdominal organs are given. He used the body of a young female animal in a rather inferior state of preservation. This treatise is also published separately.

8. ———.—"Ueber Brachycephalie und Brachyencephalie des Gorilla und der anderen Affen." *SB. Math.-Phys. Cl. Ak. Wiss. München*, 1881. Bd. xi., pp. 379–390, 2 figs.

9. ———.—"Die dritte oder untere Stirnwindung und die innere obere Scheitelbogenwindung des Gorilla." *Morph. Jahrb.*, 1882. Bd. vii., pp. 312–322. (The author had the use of five gorilla brains—all that were in Germany at that time.)

10. **Bolau, H.**—"Die Menschenähnlichen Affen des Hamburger Museums." *Abh. aus dem Gebiete der Naturwiss. Hamburg-Altona*, 1876. Bd. vi., Festgabe pp. 61–90, 2 photo-plates. Bolau gives a description of the external characters and abdominal and genital organs of three animals, sent home from the Gaboon region in spirit. (See Pansch, 67.)

11. **Broca, Paul.**—"Etude sur le Cerveau du Gorille." *Revue d'Anthrop.*, 1878. Ser. 2, t. i., pp. 1–46, plates i.–iii. The brain was not in a good state of preservation, yet this is one of the best descriptions given. It was the brain of an adult male animal.

12. **Broesike.**—"Ueber die Krankheiten und Todesursache des Gorilla Mpungu." *SB. Ges. Naturforsch. Freunde Berlin*, 1877. Pp. 262–267. A post-mortem inspection of Falkenstein's Gorilla.

13. **Chapman, H. C.**—"On the Structure of the Gorilla." *Proc. Ac. Nat. Sci. Philadelphia*, 1878. Pp. 385–394. Gives figures of the face, head, hands, feet, and deep muscles of the sole. Dissection of a young male animal sent home in spirit.

14. ———.—"Observations upon the Brain of the Gorilla." *Op. cit.*, 1892. Pp. 203–212. Gives 4 figs. A young brain sent to him in spirit by a missionary in the Gaboon.

15. **Chudzinski, T.**—"Note sur le Foie d'un jeune Gorille mâle, etc." *Bull. Soc. Anthrop. Paris*, 1884. Ser. 3, t. vii., pp. 608–616, 2 figs. See also p. 743 for note on this by Deniker.

16. ———.—"Sur les Muscles peaussiers du Crâne et de la Face observés sur un jeune Gorille mâle." *Bull. Soc. Anthrop. Paris*, 1885. Ser. 3, t. viii., pp. 583–586.

16*a*. **Deniker, J.**—"Sur un fœtus de Gorille." *Compt. Rend. Ac. Paris*, 1884, t. xcviii. pp. 753–756.

17. ———.—"Recherches Anatomiques et Embryologiques sur les Singes Anthropoides." *Arch. Zool. Exper.*, 1885. Ser. ii., t. iii. bis., Mém. 3, pp. 265, 8 pls. Published separately at Poitiers, 1886. Profuse illustrations of brain, skull, skeleton, viscera, and external characters. Deniker's is the best work upon the gorilla; he describes very minutely the anatomy of a fœtal animal, and used evidently the same fœtus in his description in *Bull. Soc. Anthrop. Paris*, 1884. Ser. 3, t. vii., pp. 447–451. He used the body of an adult gorilla for comparison during his dissection.

18. ———.—"Sur le developpement du crâne chez le Gorille." *Bull. Soc. Anthrop. Paris*, 1885. Pp. 703–714.

19. **Deniker et Boulart.**—"Note sur les sacs laryngiens des Singes Anthropoides." *Journ. Anat. et Physiol.*, 1886. Vol. xxii., pp. 51–62, pls. iii.–iv.

20. **Duckworth, W. L. H.**—"Variations in crania of *Gorilla savagei*." *Journ. Anat. and Physiol.*, 1895. Vol. xxix., pp. 335–345.

21. **Du Chaillu, P. B.**—"Explorations and Adventures in Equatorial Africa, etc." London: 1861. 8vo, xviii. and 479 pp., 27 pls. "A Journey to Ashango Land, etc." London: 1867. 8vo, xxiv. and 501 pp., 22 pls.

22. **Duvernoy, G. L.**—"Des Caractères anatomiques des grands Singes." *Arch. Mus. Hist. Nat. Paris*, 1855–56. t. viii., pp. 1–248. Three memoirs are given; (1) upon the skeleton, (2) upon the comparative anatomy of the great apes, and (3) a description of parts of the anatomy of an adult male gorilla and a young female animal.

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24. **Eisler, P.**—"Das Gefäss- und periphere Nerven-system des Gorilla, etc." Halle: 1890. 4to, 78 pp., 9 pls. Excepting Deniker's, this is the only description of the arteries and nerves of the gorilla in existence. Two gorillas were dissected.

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27. **Féré, C.**—"Deuxième note sur la Topographie cranio-cérébrale chez les Singes." *Journ. Anat. et Physiol.*, 1885. t. xxi., pp. 298–303. Gives outline of a gorilla brain.

28. **Flower, W. H.**—"The Organs of Digestion of the Mammalia." *Med. Times and Gaz.*, 1872. Feb. 24–Dec. 14. For gorilla see under March 23. Huxley and he base their descriptions upon the viscera of the same individual.

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30. **Franquet, E.**—Appendix to St.-Hilaire (72). Pp. 91–97. External characters, habits, etc.

31. **Giglioli, E. H.**—"Studii Craniologici sui Cimpanze." *Ann. Mus. Civ. di Storia Nat. Genova*, 1872. Vol. iii., pp. 56–179, 2 pls. He employed three gorilla skulls for comparative purposes.

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33. **Halford, G. B.**—"'Lines of Demarcation' between Man, Gorilla, and Macaque." Melbourne: 1864. 4to, 21 pp. A purely polemical article.

34. ———.—"On the Skeleton of the Gorilla." *Trans. and Proc. R. Soc. Victoria*, 1866. Vol. vii., pp. 34–49. Male and Female in Nat. Mus., Melbourne.

35. **Hamy, E. T.**—"De l'épine nasale antérieure dans l'ordre des Primates." *Bull. Soc. Anthrop. Paris*, 1869. Ser. 2, t. iv., pp. 13–28.

36. **Hartmann, R.**—"Beiträge zur . . . Kenntniss der Sogennanten Anthropomorphen Affen." *Archiv. Anat. und Physiol. Leipzig*, 1872. Pp. 107–152. Historical, Ext. Charact., etc. 1875, pp. 265–303, pp. 723–744, Osteology. 1876, pp. 636–661, Bones of extremities.

37. ———.—"Ueber neues die anthropomorphen Affen betreffendes Material." *SB. Ges. Nat. Freunde Berlin*, 1876. Pp. 22–26.

38. ———.—"Beiträge zur Kenntniss der sogenannten anthropomorphen Affen, iv., v." *Zeitschr. Ethnol.*, 1876. Bd. viii., pp. 130–133; 1877, Bd. ix., pp. 117–128.

39. ———.—"Ueber das Hüftgelenk der Anthropoiden Affen." *SB. Ges. Nat. Freunde Berlin*, 1877. Pp. 85–89.

40. ———.—"Der Gorilla, etc." Leipzig: 1880. 4to, pp. 160. 84 figs of 28 skulls are given, with very good coloured illustrations and photographs of the external characters of the gorilla.

41. **Hartmann, R.**—"Ueber den Torus occipitalis transversis, etc." *SB. Ges. Nat. Freunde Berlin*, 1880. Pp. 159–162. A critical article.

42. ————————.—"Ueber die Weiblichen Geschlechtstheile der Anthropoiden Affen und die Brunst der Affen im Allgemeinen." *Verh. Berl. Ges. Anthrop.* in *Zeitschr. Ethnol.*, 1886. Bd. xviii., pp. 431–433.

43. ————————.—"Anthropoid Apes." Internat. Sci. Ser., London, 8vo, 1885, viii. and 326 pp. This volume contains all Hartmann's general results; a very good *resumé* of the literature on apes is given. Hartmann's work is of very little use for future purposes, owing to the fact that he deals only in general statements, and never gives a list of the material on which these statements are based.

44. **Heckel, Ed.**—"Etude sur le Gorille du Musée de Brest." *Revue d'Anthrop.*, 1876, t. v., pp. 1–20, pl. i.

45. **Hepburn, David.**—"The Comparative Anatomy of the Muscles and Nerves of the Superior and Inferior Extremities of the Anthropoid Apes." *Journ. Anat. and Physiol.*, 1892. Vol. xxvi., pp. 149–186, pl. iii., and pp. 324–356, pl. ix.

46. ————————.—"The Integumentary Grooves on the Palm of the Hand and Sole of the Foot of Man and the Anthropoid Apes." *Op. cit.*, 1893, vol. xxvii., pp. 112–130. Numerous figures are given.

47. **Hermes, O.**—"Aus dem Gefangleben des Gorilla." *Zeitschr. Ethnol.* Berlin: 1892. Bd. xxiv., p. 576–582.

48. **Hervé, G.**—"Le Circonvolution de Broca chez les Primates." *Bull. Soc. Anthrop. Paris*, 1888. Pp. 275–314.

49. ————————.—"Crâne du Jeune Gorille." *Op. cit.*, 1893. Pp. 387–389.

49*a*. **Huxley, T. H.**—"Evidence as to Man's Place in Nature." London: 1863. 8vo.

49*b*. ————————.—"The Structure and Classification of the Mammalia." *Med. Times and Gaz.*, 1864, Feb. and March.

50. **Kneeland, S.**—"On the Skeleton of the Great Chimpanzee, *Troglodytes gorilla*." *Boston Journ. Nat. Hist.*, 1853. Vol. vi., pp. 336–347. Description of the skeleton of an adult male gorilla.

51. **Laboullay, G.**—Appendix to St.-Hilaire (72), pp. 83–91. Habits and proportions.

52. **Langle, F. de.**—"Mœurs d'un jeune Gorille." *Compt. Rend. Ac. Paris*, 1866. t. lxiii., p. 739.

53. **Lenz, H. W. C.**—"Die Anthropomorphen Affen des Lübecker Museums." Lubeck: 1876. 4to, 20 pp. Numerous photographs of museum specimens are given.

54. **Lucae, J. C. G.**—"Die Hand und der Fuss." *Abhand. Senchenbergisch. Naturf. Ges. Frankfurt*, 1865. Bd. v., pp. 275–332, 4 pls.

55. **Macalister, A.**—"Muscular Anatomy of the Gorilla." *Proc. Roy. Irish Acad., Science*, 1873. Ser. 2, vol. i., pp. 501–506. Only some of the muscles were noted; figures of the ligaments of the shoulder joint, pronator radii teres and short muscles of the hand are given. The body of a young female animal was used.

56. **Magitot, E.**—"L'Homme et les Singes Anthropomorphes." *Bull. Soc. Anthrop. Paris*, 1869. Ser. ii., t. iv., pp. 113–145. Deals with the teeth of the gorilla in part of the article.

57. ————————.—"Traité des Anomalies du Système Dentaire, etc." Paris: 4to, 1877, iv. and 303 pp., 20 pls.

58. **Meyer, A. B.**—"Notizen über die Anthropomorphen Affen des Dresdener Museums." *Mitth. Zool. Mus. Dresden*, 1877. Pp. 223–247, 13 pls.

59. ————————.—"Ein angeblicher Bastard zwischen Gorilla und Chimpanse." *Zoolog. Garten.*, 1881. Bd. xxii., pp. 231–236. Von Koppenfels' supposed hybrid.

60. **Milne-Edwards.**—"Sur l'existence d'un Gorille à la Ménagerie du Muséum d'Histoire Naturelle." *Compt. Rend. Ac. Paris*, 1884. t. xcviii., pp. 959–960. The first living gorilla in France.

61. **Mivart, St. George.**—"On the Appendicular Skeleton of the Primates." *Phil. Trans.*, 1867. Vol. clvii., pp. 299–429, pls. xi.–xiv.

61*a*. ————————.—"Contributions towards . . . Knowledge of the Axial Skeleton in the Primates." *Proc. Zool. Soc. London*, 1865. Pp. 545–592.

62. **Moeller, J.**—Beiträge zur Kenntniss des Anthropoid-gehirns." Berlin: 1891. 4to, 17 pp., 2 pls. (Moeller appears to have had access to fresh material, but as yet I have not seen his book.)

63. **Nissle, C.**—"Beiträge zur Kenntniss der sogenannten anthropomorphen Affen, III. 'Mafuca'—ein Gorilla." *Verh. Ges. Anthrop. Berlin* in *Zeitschr. Ethnol.*, 1876. Bd. viii., pp. 46–60.

64. **Owen, R.**—"On a New Species of Chimpanzee." *Proc. Zool. Soc. London*, 1848. Pp. 27–35. (Founded upon three skulls sent to him by Savage).

64*a*. ————————.—"On the Gorilla (*Troglodytes gorilla*, Sav.)." *Op. cit.* 1859, pp. 1–23, characteristics and distribution of gorilla.

65. ————————.—"Osteological Contributions to the Natural History of the Chimpanzees, etc." *Trans. Zool. Soc. London*, 1849, vol. iii., pp., 381–422, pls. lviii.–lxiii.: description of the skull of *Troglodytes gorilla* discovered by Savage. 1853, vol. iv., pp. 75–88, pls. xxvi.–xxx.: cranium of adult male from R. Danger, W. Africa. 1853 (?), vol. iv., pp. 89–115, pls. xxxi.–xxxvi.: jaws and vertebral column. 1862, vol. v., pp. 1–31, pls. i.–xiii.: bones of extremities. 1865, vol. v., pp. 243–284, pls. xliii.–xlix.: external characters.

66. ————————.—"Memoir on the Gorilla." London: 1865. 4to. The description of the soft parts is based upon a young animal sent home in spirit and not in a good state of preservation. The external characters are described from three skins. The memoir contains the substance of Owen's articles in the *Transactions* of the Zoological Society for 1849,–53,–57,–62.

67. **Pansch, A.**—"Ueber die Furchen und Windungen am Gehirn eines Gorilla." Part of Bolau (10), pp. 84–90.

68. **Reade, W. W.**—"The Habits of the Gorilla." *Amer. Nat.*, 1867, vol. i., pp. 177–180. Popular note.

69. **Reading, J. H.**—"Habits [and Distribution] of the Gorilla." *Amer. Nat.*, 1884, xviii., pp. 1,277 and 1,278.

69*a*. **Rex, H.**—"Ein Beitrag zur Kenntnis der Muskulatur der Mundspalte der Affen." *Morph. Jahrb.*, 1887. Bd. xii., pp. 275–286, pl. xvii.

70. **Ruge, G.**—"Untersuchungen über die Gesichtsmuskeln der Primaten." Leipzig, 1877, fol., pp. 130, 62 figs. Supplementary to that work is an article specially devoted to the facial muscles of the gorilla in *Morph. Jahrb.*, 1887. Bd. xii., pp. 459–529, pl. xxiv.

71. **Savage, T. S.**—"Notice of the External Characters and Habits of Troglodytes Gorilla, a new species of Orang from the Gaboon River; Osteology of the same, by J. Wyman." *Boston Journ. Nat. Hist.*, 1847. Vol. v., pp. 417–443, 4 pls. of skulls. This (or rather, the short abstract in *Proc. Boston Soc. N.H.*, vol. ii., pp. 245–247, published Aug., 1847) is the first notice of the gorilla in scientific literature. A review appeared in *Amer. Journ. Sci. and Art*, 1849, 2nd series, vol. viii., p. 141.

72. **St. Hilaire, I. G.**—"Description des Mammifères Nouveaux, etc." *Arch. Mus. Hist. Nat.*, 1858–61, t. x., pp. 1–102. Including appendices by Franquet and Laboullay, q.v. He had six more or less complete animals to found his conclusions on. He names the gorilla—*Gorilla gina*.

73. **Slack, J. H.**—"Mammalogical Notices." *Proc. Ac. Nat. Sci. Philadelphia*, 1867, pp. 34–38. Some measurements of a gorilla skeleton.

74. **Struthers, John.**—"On the Articular Processes of the Vertebræ in the Gorilla, etc." *Journ. Anat. and Physiol.*, 1893. New ser., vol. vii., pp. 131–138. Deductions are drawn from an examination of twenty adult skeletons.

75. **Swayne, S. H.**—"Comparative Measurements of the Skeleton of Man and the Gorilla" *Proc. Bristol Nat. Soc.*, 1868, vol iii, pp. 39–41. Skeleton in the Bristol Museum.

76. **Symington, J.**—"Observations on the Myology of the Gorilla and Chimpanzee." *Rep. Brit. Assoc.*, 1889. London, 1890. Pp. 629 and 630.

77. ————.—"The Vertebral Column of a Young Gorilla." *Journ. Anat. and Physiol.*, Oct., 1889. New series, vol. iv., pp. 42–51. Two figs.

78. **Thane, G. D.**—"The Brain of the Gorilla." *Nature*, 1876, Dec., vol. xv., pp. 142–144. On the description by Pansch.

79. **Thomson, W.**—"*The Transversalis Pedis in the Foot of the Gorilla.*" *Austral. Med. Journ.*, Melbourne, 1864, vol. ix., pp. 15–24. The writer had never examined the foot of a gorilla.

80. **Török, A. von.**—"Sur le Crâne du jeune Gorille du Musée Broca." *Bull. Soc. Anthrop. Paris*, 1881, ser. 3, t. iv., pp. 46–57.

81. ————.—"Ueber den Schaedel eines jungen Gorilla. Zur Metamorphose des Gorillaschaedels." *Month. Internat. Journ. Anat. and Physiol.*, 1887, vol. iv., pp 137–176, 227–274, pls. iv–vi. For his "Neuere Beiträge zur Reform der Kraniologie" *see* vols. x., xi., and xii. (1893—94–95) of the same journal.

82. **Topinard, P.**—"De l'Evolution des Molaires et des Prémolaires chez les Primates, etc." *L'Anthropologie*, 1892, t. iii., pp. 641–710. Many figures are given.

83. **Turner, W., & Burt.**—"Exhibition of Three Skulls of the Gorilla, received from M. du Chaillu, etc." *Proc. Roy. Soc. Edinburgh*, 1865, vol. v., pp. 341–350.

84. **Virchow, R.**—"Ueber den Schaedel des jungen Gorilla." *Monatsber. Akad. Wiss. Berlin*, 1880, pp. 516–543, 8 figs.; also *SB. Akad. Wiss. Berlin*, 1882, pp. 671–678. Deals with the characters of three skulls of young animals.

85. **Waldeyer, W.**—"Das Gorilla-Rückenmark." *Abh. Akad. Wiss. Berlin*, 1888, art. 3, 147 pp., 12 pls., published 1889.

86. **Walker, R. B. N.**—Report of Meeting. *Proc. Lit. Phil. Soc. Liverpool*, 1866. No. xix., pp. 224–229. Remarks on skeleton presented by him to Liverpool Museum.

87. **Wyman, J.**—"Report on the Cranium of the Engéena (*Troglodytes gorilla*) . . . presented to the Society by G. A. Perkins; also on that belonging to the Essex County N. H. Soc." *Proc. Boston Soc. N. H.*, 1850, vol. iii., p. 179.

87*a*. ————.—"Observations on the Cranium of a young Gorilla." *Proc. Boston Soc. N. H.*, 1863, vol. ix., p. 203.

87*b*. ————.—"On the Skeleton of a Hottentot." *Tom. cit*, 1865, pp. 352–357. Measurements of pelvis and limb-bones. See also under Savage (71).

ARTHUR KEITH.

III.

The Lobster in Commerce and Science: its Name and Nature.[1]

LOBSTERS also are cannibals. Especially are the larval forms weak in moral sense. They prefer to feed on one another, it is said, even when suitable food of a different kind is offered them. The adults think nothing of chopping asunder a defenceless brother, neither have they any objection to filling their stomachs with lobster eggs. All this is not for want of outside enemies. As Dr. Herrick puts it, "Every predaceous fish which feeds upon the bottom may be an enemy of the lobster. The cod is one of the most destructive to small lobsters, after the larval stages are past." But, in truth, the origin of Dr. Herrick's interesting and finely illustrated volume is due to the fact that the lobster has another and more dangerous enemy than any fish, however predaceous. Its chief peril lies in that combination of cleverness and stupidity which man so often exhibits in meddling with other races. He is always clever enough to conquer, not always skilful enough to preserve. A fisherman was asked to explain where the marriageable maidens would be found if all the young girls in the world were perpetually destroyed. He thought the question not to the purpose, because a human mother does not bring forth on an average eleven children, whereas the lobster mother on an average bears eleven thousand. Some crustaceans produce eleven hundred thousand eggs, or many more. Whatever the number produced, an average of two or three of the offspring surviving to maturity suffices to maintain the numbers of any given species. It might seem almost needless to take precautions for saving so small a proportion of the whole yield of lobster spawn. Dr. Herrick and others who have studied the subject most closely are far from thinking so. Though there may be little reason to fear the extermination of a creature so prolific, it may be very easy to worry or scare it away from those regions where its presence is most desirable, and by sheer carelessness and want of thrift to destroy a valuable source of food-

[1] "The American Lobster: a Study of its Habits and Development." By Francis Hobart Herrick, Professor of Zoology in Adelbert College of Western Reserve University. Being Article I., extracted from *Bull. U.S. Fish Comm.* for 1895. Pp. 1–282, plates A.–J., and 1–54. Washington: Government Printing Office, 1895.

supply. The females carrying the extruded eggs on their swimmerets are rather ludicrously spoken of as 'berried hens.' The sale of these has sometimes been prohibited for short portions of the year. Recently, however, it has been ascertained that the eggs are thus carried for many months, with the result that a prohibition of bringing 'berried hens' to market at any time is now recommended. Regulations can rarely be made perfectly logical. Under that proposed, a lobster with the 'coral' still in its ovaries would be saleable, although it is as much the potential mother of millions as one with the eggs already extruded. But rules too stringent might destroy the industry they are intended to foster, while within due limits they may at least have an educational value.

To repair the ravages of waste, the artificial hatching of lobster-spawn is now being carried out with increasing success. Dr. Herrick's laborious and prolonged investigations enable him to give a fuller account than has hitherto been presented of the numerous moults and larval stages which intervene between the birth of the lobster and its adult condition. During the first three stages the larva is a 'schizopod,' the schism of the feet from which this title is derived supplying it with half-a-dozen pairs of double-branched appendages of the trunk. In these, one branch is adapted for swimming, the other is prepared for walking or grasping. Only in the fourth stage do the swimming-branches practically disappear, when the swimming-apparatus of the abdomen or tail is ready at length to take up the function which the trunk now lays down. The early forms, with their translucent cuticle, have means and opportunity of displaying changeful and agreeable colours. Later on, when the animal is an inch or more in length and the shell no longer transparent, there are brilliant hues of green and brown, and blue and white, due wholly to the pigments of the shell, and no longer, as at an earlier period, in part to the colouring of the internal organs. Among the adults, "occasionally red living lobsters are seen," though they are rarely as bright as those which have been boiled.

From a careful weighing of the evidence in regard to the size attained by lobsters, Dr. Herrick estimates that the greatest weight is about twenty-five pounds. At the price not uncommonly asked in England of a shilling a pound, a specimen of that weight would be expensive, though forty years ago, at Grand Manan, in the United States, it might have been had for a penny. The largest number of eggs carried by a female is supposed to approach, without quite reaching, a hundred thousand, about a pound weight of 'berries.' A female stripped of her eggs is likely to weigh less, it is said, than a female of the same length that has had no eggs of which to be stripped.

The differences between the European and American lobster are not considerable. Among them it may be noted that on the average the American is the larger, and that it has teeth on the underside of

the rostrum; these are wanting in the European species. As to the names, Dr. Herrick is not entirely consistent throughout his volume, having probably written the bulk of it before he engaged in that discussion of nomenclature which appears on the eighth and ninth pages. On this point the remarks of Mr. J. T. Cunningham in the May number of NATURAL SCIENCE are very opportune, for he illustrates them from the two species here in question. In dealing with synonyms, Mr. Cunningham recommends us to "Choose that which is associated with what you consider the most correct description and classification. For example, *Homarus vulgaris* has been used by the latest and best authorities on the systematic affinities of the lobster, and therefore should not be changed." He does not explain what is to be done if one finds the most correct description under one synonym and the most correct classification under another. There is the same ambiguity in his appeal to "the latest and best authorities," since by the very references he gives he intimates (in a very gentle manner) that the latest authorities are sometimes not the best. The name *Homarus vulgaris* was given to the European lobster by Henri Milne-Edwards in 1837. The name *Astacus gammarus* was given to it in 1819 by Leach, who took over its specific designation from Linnæus. Dr. Herrick has persuaded himself to call it *Homarus gammarus* (Linn.), not in the least because he shares Mr. Cunningham's principles of nomenclature, which "would lead to mere anarchy and chaos,"[1] but from an accidental misapprehension of the authorities concerned. He says that "Latreille, in 1810, designated as the type of the old genus *Astacus* the species *A. fluviatilis* Fabricius (=*Cancer astacus* Linné), which is the European crayfish. In 1815 Leach began to dismember this genus by giving to the Norwegian lobster the name *Nephrops*. Later, in 1819, he proposed the generic term *Potamobius*[2] to embrace the true crayfishes, leaving the lobster alone in possession of the Aristotelian name." It is unnecessary to quote the whole of the long paragraph. It ends by saying that "Stebbing, apparently unaware of Latreille's restriction, proposed to restore the old terminology of Leach." Latreille's book, "Considérations générales, etc.," 1810, far from being overlooked, had, in fact, caused me some anxiety, though only for a moment. So far as *Astacus* is concerned it added nothing to previous knowledge, and in the "Table des Genres avec l'indication de l'espèce qui leur sert de type," it may fairly be argued that "*Astacus fluviatilis*, Fab.," is given not as *the* type, but merely as *a* type, an example, a specimen of the genus, the handiest one for a Parisian reader to recognise. But, if it be insisted that Latreille here intended to set up the crayfish as technically type of the genus, in preference to the lobster, of which his book makes no mention, the answer is simple.

[1] *See* Editorial Note, p. 302.

[2] Not *Potamobia*, as I supposed, until the well-informed American carcinologist Miss Mary J. Rathbun, called my attention to the inaccuracy.

His intention was inoperative, because he had been forestalled by an earlier writer. J. C. Fabricius, in his various writings, of which it will be sufficient to cite the "Species Insectorum," 1781, and the "Entomologia Systematica," 1793, consistently places *Astacus marinus* (*Cancer gammarus*, Linn.) as the first species of the genus *Astacus*, giving to *A. fluviatilis* invariably the second place. There can therefore be no reasonable gainsaying that he made the European lobster, and not the river crayfish, the type. From this it follows, in accordance with explanations given as well by Dr. Herrick as myself, and recently accepted by Dr. Arnold Ortmann, that the generic name of the lobster is properly *Astacus*, and that of the European crayfish *Potamobius*.

Dr. Herrick discusses very fully the structure and growth of the lobster's shell, and the manner of its exuviation. He controverts a prevalent opinion that the carapace is ruptured along the middle line to assist the process. "There is normally no rupturing of the shell in any part in the course of the molt. The entire exoskeleton, with the linings of the œsophagus, stomach, and intestine, comes off as a whole, and the animal leaves it by drawing the anterior parts of the body backward, and the abdomen and its appendages forward, through an opening made by the elevation of the carapace." A foot-note explains that the lining of the alimentary tract is, of course, ruptured. Also, though the carapace remains unbroken, it is made more pliable during the preparation for the moult by the absorption of the lime salts of the shell along the median line and other areas. The most surprising part of the process is the extraction of the gigantic muscles of the large claw through the narrow joints of the arm. They have to undergo distention and compression to an extraordinary degree. Their passage is compared to the drawing of a wire through the contracting holes of a draw-plate. "The muscles appear to be stretched out like a stick of candy, but, apart from their elasticity, they are probably aided in accomplishing this by the removal of water from the blood. The parts are very much distorted immediately after they are free, and are quite hard, but they soon take up water and assume their natural form, with a proportional increase in size."

Of the gastroliths Dr. Herrick says that they, "though often called crab's eyes, are found only in the crayfish and lobster, so far as known." This is probably said in forgetfulness of the account given by Patrick Browne of their occurrence in the land-crabs of Jamaica. Dr. Herrick carefully discusses their origin, structure, and use. After considering most of what has been written on the subject, he deems it likely "that the gastroliths in the lobster represent the lime which has been removed by absorption from the old shell preparatory to the molt, as well as, possibly, a small amount which may have entered the blood from the food during the molting period." Such a theory of their origin may, perhaps, dispense with any further

explanation of their use. They can be regarded as waste products which in this way are most conveniently eliminated from the body. In opposition to a commonly received view, that they assist in supplying lime for the formation or hardening of the new shell, it is pointed out that the proportion they bear to the whole exoskeleton is so trifling that they cannot be of any practical service in providing calcareous matter for it. None the less, the position of the gastroliths is so peculiar that they are not easily thought of as mere offscourings. One lies on each side of the stomach in a pocket formed between the old cuticle which is about to be shed and the new one which is to take its place. Had they no purpose to serve but that of throwing off superfluous matter, one would expect them to be cast out along with the old lining of the stomach. But this is not the case, and it may therefore be conjectured that in the first instance they give support to the weak and soft new lining, and that, when presently their prismatic structure breaks up and falls into the cavity of the stomach, they then help to fill for a time what would otherwise be an aching void. The 'soft lobster,' after the exertion of shedding its tunic, may soon begin to feel hungry, and yet the feeding upon miscellaneous prey would not be without its serious perils when the stomach is just recovering from the delicate task of exuviation.

Without going into further details, it may be said in conclusion that, after a complete study of Dr. Herrick's volume, the reader will probably be disposed to regard its writer as "the latest and best authority" on the American Lobster.

THOMAS R. R. STEBBING.

IV.

The Dewey Decimal Classification and the International Catalogue of Science.

THE rapid increase in the growth of scientific literature, and the consequent need for a systematic bibliography, have given rise to many schemes, more or less extensive, for keeping scientific workers informed, with as little delay as possible, of the publication of books and memoirs in their special departments. The history of works of this kind shows a gradual evolution, with ever increasing adaptation to the environment as regards completeness, classification, and rapidity of publication. To take an illustration from that branch of science with which I am most familiar:—The "Bibliotheca Historico-naturalis" of Engelmann, published in 1846, was succeeded, in 1861, by the "Bibliotheca Zoologica" of Carus and Engelmann. Then followed, in 1864, the *Zoological Record*, published annually, whilst in 1878 the fortnightly issue of the *Zoologischer Anzeiger* of Carus began, and is now continued with somewhat modified organisation in conjunction with the zoological bureau of Dr. H. H. Field.

In the case of a bibliography which is issued in sections, one of the most urgent needs is the classification of the titles, so that students may readily select the references which concern them; and of practical devices for securing this end, the use of a scheme with numbered divisions seems to have been generally approved. The advantages of such a system are obvious: when the list of classes has once been drawn up and the numbers affixed to them, the latter do duty for the headings of the former (*e.g.*, 595 may stand for *Arthropoda* or 853 for *Italian fiction*), with great advantage as regards brevity. Furthermore, a series of slips or titles, if arranged numerically, are thereby put in systematic order. Thirdly, the numbers with which one is habitually working become fixed in the memory and thus facilitate the looking up of references and the arrangement of facts and materials of all kinds; whilst, lastly, the ease of cross-reference is greatly increased. Hitherto the scheme based on these principles which has been most widely used, is undoubtedly the "Decimal Classification" of Melvill Dewey, and its adoption in the pages of this Journal, in those of the *Revue scientifique*, and of the *Zoologischer Anzeiger*, as well as some dozen other periodicals less connected with natural science, renders it appropriate to devote a little space to its exposition. This is the more needful as those who see the

numbers for the first time, and who lack the patience or leisure to acquire a grasp of the system on which they are based, are very apt to be prejudiced against it, condemning it unheard as an artificial and cumbrous device.

The system consists in dividing the subjects on which books have been written into classes and fixing a number to each. There are ten main divisions; each of these is subdivided into ten, and each of these once more into ten, so that 1,000 so-called "sections" are formed. The "Natural Sciences" (in the wide sense of the term) occupy the sections, 500–599, whilst "Zoology" extends from 590 to 599, the several class-numbers being allocated thus:—

590. General Zoology.
591. Anatomy and Physiology.
592. Invertebrata.
593. Protozoa, Porifera, Coelenterata.
594. Mollusca, Brachiopoda, Bryozoa, Tunicata.
595. Articulata.
596. Vertebrata.
597. Pisces, Amphibia (Ichthyopsida).
598. Reptilia, Aves (Sauropsida).
599. Mammalia.

By the use of decimals, these sections are further divided into sub-sections to any degree of minuteness which may be desired; for instance, 595.3 is "Crustacea," subdivided thus:—

595.31 Entomostraca.
.32 Phyllopoda.
.33 Ostracoda.
.34 Copepoda.
.35 Cirripedia.
.36 Malacostraca.
.37 Arthrostraca.
.38 Thoracostraca.
.39 Gigantostraca.

By the mere addition of decimal places, any one of these may be divided and subdivided again, if at any time that be deemed desirable. The insertion of the decimal point makes the proper order of the divisions clear, and also makes it more easy for the eye to catch the main class-number. There is no profound mystery in this use of the decimal; it is nothing more than a practical convenience.

In order to indicate Geographical distribution, a series of numbers has been allotted to the different divisions of the earth's surface:—

.4 Europe.
.41 Scotland, Ireland.
.42 England.
.43 Germany.
&c. &c.
.5 Asia.
.6 Africa.
.7 North America.
.8 South America.
.9 Oceania.

These numbers, *always with the same signification*, can be added to the number belonging to any subject which admits of being considered geographically, whether it be poetry or periodicals, beetles or mosses; and numbers are provided for carrying out the subdivisions as far as the countries in the British Isles or the States of the American Union.[1]

Those who wish to see the whole system set forth should consult Dewey's original work,[2] and I may, perhaps, be allowed to refer any who are curious to see it applied to the literature of natural science, to an effort of my own to carry out its principles.[3]

Such, in briefest outline, is the Decimal Classification of Melvill Dewey, which has been published for more than twenty years, has been adopted by upwards of 300 libraries in America, in this country, and on the Continent, and is now used by Messrs. Lafontaine and Otlet in the various publications issued by the Institut International de Bibliographie at Brussels, and by Dr. Field in the work of the "Concilium bibliographicum" at Zürich. My own experience, extending over the past five years, enables me to speak of it with great confidence as a thoroughly practical scheme, though I confess, on first acquaintance, I regarded it with considerable suspicion; and I have never met anyone, who had given it a fair trial, that was not deeply impressed with its many valuable qualities.

It is, of course, obvious that Decimal classification and the Dewey classification are not necessarily united. Any number of schemes might be elaborated, and decimal class-numbers applied to them: in fact, within the last few months a rival champion has entered the lists against the American system, under the auspices of no less a body than the International Catalogue Committee of the Royal Society, and it behoves all who are interested in the conflict (which means practically all scientific men) to make a critical examination of the combatants before deciding which they will back. At the outset it may be observed that it is incumbent on the new-comer to show marked superiority over the present champion, for in its absence the well-known principle would be applied—namely, that it is better to adopt a classification which has been long in print and is widely adopted, unless the superior merits of the new one fully compensate for the change.

We may now proceed to examine a few sections of the Royal Society's scheme, confining our attention to those that relate to topics treated of in NATURAL SCIENCE. One of the most conspicuous features

[1] [In this Journal, the numbers indicative of geographical divisions have been added within round brackets, a method proposed, for the avoidance of confusion, by the Brussels Institute, and now generally adopted.—ED. NAT. SCI.]

[2] DEWEY, Decimal Classification and relativ index. Fifth Edition, 1894. Library Bureau, Boston, 146 Franklin Street, and London, 21 Bloomsbury Street. Price 25s.

[3] Manchester Museum Handbooks. Catalogue of the books and pamphlets in the Library. Manchester: Cornish. 1895. Price 2s. 6d.

of the Dewey scheme is the wide application of many of its groups of numbers: for example, each branch of science has the following divisions:—

.1 Philosophy, Theories, Nomenclature.
.2 Handbooks ("Compends" of Dewey).
.3 Dictionaries.
.4 Essays, Tracts.
.5 Periodicals.
.6 Societies ("Academies" of the Brit. Mus. Cat.).
.7 Study, Teaching, Museums.
.8 Collected Works.
.9 History.

These are applied alike to all main divisions from "Religion" to "Useful Arts"; whereas in the Royal Society scheme nothing is said of these subdivisions in Anthropology or Zoology, in Botany the Dewey plan is followed, and in Geology and its subdivisions we have:—

	Geology, General.	*Mineralogy.*	*Palæontology.*
.1	History, Philosophy.	Literature.	History, Philosophy.
.2	Handbooks.	Classification.	Handbooks.
.3	Dictionaries.	Nomenclature.	Dictionaries.
.4	Tracts, Ephemera.	Teaching.	Tracts, Ephemera.
.5	Periodicals.	Museums.	Periodicals.
.6	Societies.	..	Societies.
.7	Education.	..	Research and Education.
.8	Research.	..	Classification and Nomenclature.
.9	Museums.	..	Collections and Museums.

Here "teaching" and "museums," though intimately connected in practice, are disjoined, and no place is left for collected works.

Again, as we have already mentioned, the geographical numbers of Dewey form a single rational system of universal application, and therefore easily remembered, but here we have the following choice assortment:—

	Anthropology.	*Botany.*	*Zoology* A.	*Zoology* B.	*Geology.*
.1	..	..	Europe ..	Palæarctic ..	Europe.
.2	Europe ..	..	Asia	Ethiopian ..	Asia.
.3	Asia ..	..	Australia ..	Indian ..	Africa.
.4	Africa ..	Europe ..	Africa ..	Australian ..	Australia and Polynesia.
.5	America ..	Asia ..	N. America ..	Nearctic ..	N. America.
.6	Australasia and Oceania	Africa ..	S. America ..	Neotropical ..	S. America.
.7	Outlying Islands ..	N. America and Islands	Pacific Archipelago ..	Oceans beyond 100 fathoms.	Arctic.
.8	Widely diffused races	S. America and Islands	Atlantic Islands	..	Antarctic.
.9	..	Australasia & Polynesia	Oceans beyond 100 fathoms.	..	..

It seems hardly worth while to criticise these schemes individually; they may be allowed to answer one another. The alternative classification of zoology, however, calls for a few comments. There can be no doubt that although the faunistic regions of Wallace and Sclater may be more scientific, nevertheless the old political divisions are far more frequently used by zoological writers, and a scheme based upon them would be of far wider utility than one based on the

other. Probably, however, works treating of the animals of regions will become more numerous, and an alternative scheme which provided for them in some simple manner would be acceptable. The only one of the Royal Society systems which deals with geographical divisions smaller than continents is Geology, where we have, for example, Europe divided thus :—

.11 Austrian Empire.
.12 British Islands.
.13 France and Belgium.
.14 German Empire, Holland, and Denmark.
.15 Italy, Sicily, and Malta.
.16 Russia.
.17 Scandinavia.
.18 Spain and Portugal, Balearic Islands.
.19 Turkey, Greece, Balkan States, and Islands of Levant.

The choice of an alphabetical arrangement here is rather incomprehensible; it separates Germany and Austria, and we fail to see that it presents any advantage to justify its adoption as against Dewey's :—

.1 Scotland and Ireland.
.2 England.
.3 Germany and Austria.
.4 France.
.5 Italy.
.6 Spain and Portugal.
.7 Russia.
.8 Norway, Sweden, Denmark.
.9 Iceland, Netherlands, Belgium, Switzerland, Turkey, &c.

Turning to the Animal Kingdom, we demur at the outset to the suggestion that a different classification should be adopted for recent and fossil forms, thus :—

Fossil Zoology.	*Recent Zoology.*
.1 Protozoa, Porifera, Coelenterata.	Protozoa, Mesozoa, Porifera, Coelentera.
.2 Echinodermata.	Echinoderma.
.3 Vermes, Molluscoidea.	Polyzoa, Gephyrea, Brachiopoda.
.4 Mollusca.	Nematoda, Acanthocephala, Chætognatha, Gastrotricha.
.5 Arthropoda.	Plathelminthes, Nemertini.
.6 Fishes, Amphibia.	Chætopoda, Hirudinea, Rotifera.
.7 Reptiles, Birds.	Arthropoda.
.8 Mammalia.	Mollusca.
.9 Traces of Animals (footprints, etc.) Animals incertæ sedis.	Chordata.

The arrangement of recent animals is undoubtedly more up-to-date than that of Dewey, but as a working system it is vastly inferior to it, doubtless from want of experience on the part of the compiler. To devote a whole decimal place to the Nematoda, Acanthocephala, Chætognatha, and Gastrotricha, the titles referring to which in a year would probably fill a couple of pages of the *Zoological Record*, and to allot the same to the whole of the Chordata, the titles relating to which occupied seventy-five pages in the *Record* for 1894, shows a curious sense of proportion. The same fault is carried still further when we

find that each of the orders of mammals requires four decimal places (in Dewey they require one or at most two), and reaches its climax when we arrive at 565.9395 for "Man," and are told it "will want much subdivision."

This is followed by two tables "showing how genera and species might be treated." I have puzzled over these for some time, but cannot make them out; but, as I am given to understand this idea was early dropped for an alphabetical arrangement, any criticism of them is unnecessary.

Time and space fail me to go into further details; but to sum up, the Dewey classification is not perfect, but has been long before the public and has been well tried, it may be had in print with an elaborate index, it is simple and consistent and is based upon practical experience of the subjects on which books and memoirs actually have been written, and of the proportional numbers required by each topic. The Royal Society's classification, so far as I have examined it, has none of these advantages: it is crude, incomplete, and inconsistent, largely because it is the result, not of practical experience, but of *à priori* consideration. I conclude with two passages from Dewey's own Introduction to the fourth edition of his tables:—

"The inexperienced user is very likely to feel entirely competent, after once reading the tables . . . to institute a series of improvements. Experience proves that nothing could be more disastrous. . . . Frequently, proposed changes, carefully studied out and submitted as improvements, are shown by our old records to have been adopted and used in the exact form proposed till considerations which had not been foreseen forced us to change the form as printed. Even after years of experience one is not safe in pronouncing on an apparent improvement without consulting the voluminous records of previous experiments."

"To make out a new set of heads would involve labor and cost vastly beyond the dreams of any person who has not tried exactly this work. The time actually spent on the tables as here printed, by various competent workers, would aggregate several years and cost thousands of dollars. The uniform and urgent advice of the experienced is to adopt a poorer scheme already made rather than undertake so herculean a labor. When done, the maker may possibly be better suited with it, but it is doubtful if many others will be. It is vastly wiser for any man whose time is of value, to use it in something more practically useful to himself and his library than in trying to construct a 'satisfactory' scheme of classification. No one ever yet wholly suited himself or any one else, and probably no one ever will. By adopting this scheme already workt out he saves much time and money, gains the immense advantage of using a system in common with hundreds of others, so that he may utilise their labors and investigations and share with them the economies of co-operation."

The Manchester Museum. WM. E. HOYLE.

WE are glad that we have succeeded in obtaining the foregoing article from Mr. Hoyle. Since the International Conference on scientific bibliography, to be held at the rooms of the Royal Society

of London, on July 14 and following days, will probably spend much of its time in discussing what system of numerical indexing can be applied to the multifarious subjects of modern science, and since, so far as our experience goes, the majority of practical scientific men are not likewise practical bibliographers, we venture to think that Mr. Hoyle is doing a public service in furnishing this concise exposition of the Dewey system, and in showing how the substitutes hitherto proposed are found wanting from the practical point of view. In justice, however, to the compilers of the various schemes issued under the auspices of the Royal Society, it should be pointed out that these were merely intended to serve as a basis for discussion; and perhaps nothing worse should be said of them than that their compilation was a waste of time, since the basis of discussion ought properly to have been the Dewey classification itself. Moreover, the conflict between our contributor and the members of the Royal Society Committee is a very unequal one; for Mr. Hoyle has had more practical experience of the Dewey system than perhaps anybody in England, whereas the very distinguished gentlemen whose names are attached to the schemes which the Royal Society has submitted for criticism are the last people in the world to claim for themselves an acquaintance with practical bibliography in general, or with the Dewey system in particular.

It would be easy for us to add to the criticisms which Mr. Hoyle has already made, and to show many more points of inconsistency which the schemes offer, both with one another and with the Dewey system itself; but our space is too valuable to discuss propositions which it would never be possible to uphold seriously against some of the competent librarians and bibliographers who have been appointed by their respective governments to attend the Conference at Burlington House. Instead of criticising the details, we prefer to contrast this characteristically English mode of proceeding with the methods adopted by an eminent foreign bibliographer. For it is—is it not?—a thoroughly English custom to appoint a man who has spent his life in one branch of study to conduct skilled operations in an entirely different field. There is no doubt that, from the point of view of the newspaper public, the man who has got his first in the school of *literæ humaniores* at Oxford, will write a better leading article on, say, the potato disease than your mere biologist; but the journalistic method of getting up a subject in an hour or two, with the help of a few books of ready reference, is not the one that commends itself to the professed scientific worker. A better method is that followed by Mr. Marcel Baudouin, of the Institut International de Bibliographie Scientifique de Paris, the editor of *La Bibliographie Scientifique*, *Les Archives pr. de Chirurgie*, and the *Revue des Instruments de Chirurgie*. In the *Revue Scientifique* for May 30 he publishes various additions to, and further subdivisions of, the Dewey classification, so far as it relates to medical science. The following are the principles which have

guided him in the establishment of these additions. Considering himself bound by a resolution passed at the Brussels Conference of bibliographers, to which we have previously referred, he has accepted without question all the indications furnished by Mr. Dewey in the book published by him. "No one," he says, "can accuse me of making innovations in a field that has already been explored and to a certain extent cultivated, or of bringing disturbance into a classification, conventional, it is true, but of which the principle must be admitted in its integrity and without contest for future time." But when he proceeded beyond the tracts already traversed by Dewey and was upon unbroken ground, Mr. Baudouin did not break loose from all restraint and act as an irresponsible innovator; on the contrary: "For these additions," he says, "I have impregnated myself as well as I could with the publications of Mr. Dewey, and the principles which have guided his representatives in Europe. For those parts of which he foreshadowed the possible subdivisions, I have blindly followed his indications, sacrificing my private opinions with the sole object of arriving at an international agreement. For the rest, whenever possible, I have respected the original idea which has ruled over the establishment of this classification in its entirety." Even when making subdivisions which, it might be thought, bore no relation whatever to Dewey's work, Mr. Baudouin has not forgotten what had previously been accomplished. The numbers which he has adopted have not been taken at random, but have been suggested by their use in other parts of the Dewey classification. He has, moreover, used numbers in a similar sense in different parts of his own divisions. It is obvious that this method is of considerable assistance to the memory, and is far superior to the absolute want of agreement which, as Mr. Hoyle has shown, obtains in the schemes put forward by our distinguished countrymen.

There is one sentence in Mr. Hoyle's paper on which we would lay special stress. "The Royal Society's classification fails," he says, "largely because it is the result, not of practical experience, but of *à priori* consideration." This point is emphasised in a letter which we have just received from Dr. Charles Richet, the editor of our esteemed contemporary, the *Revue Scientifique*. He regards it as the chief merit of the Dewey system that it has not been framed in accordance with purely scientific and philosophical ideas, but as the result of the experience of practical librarians. It may further be pointed out that a system which is frankly arbitrary is, for the purposes intended, superior to one that is charmingly philosophical. For our "little systems have their day," and what may seem admirable in the year of grace, 1896, is not likely to be regarded with anything but ridicule by our descendants in 1996. Nature, moreover, as we constantly have reason to regret, does not appear to have been constituted in accordance with our philosophical categories; to take but a single instance, one already hinted at by Mr. Hoyle—what

confusion we should see if workers on different groups of the animal kingdom were requested to draw up schemes for the classification of geographical divisions suited to their own requirements!

We venture to summarise the argument by a quotation from the letter that Dr. Charles Richet has kindly addressed to us: "Those who believe it to be their duty to reform this system, or to replace it by another, do not think that the topsy-turvydom produced will have much greater weight than any doubtful progress they may make in the method of classification. After all (1) every classification is defective from the philosophical point of view; (2) every classification would be good if it were employed universally over a wide domain of knowledge. The latter will be the case with the Dewey system if we set ourselves resolutely to make our classification in accordance with his book. To my knowledge there are at least fifteen journals which employ it already."

However, to pass from a detail that can interest but few of our readers, to the other subjects of the Conference,—the following provisional suggestions have been issued by the Committee of the Royal Society. First, as we are glad to note, the idea of including applied science has been given up, and the catalogue is to be restricted to branches of pure science. It is no doubt difficult to distinguish between pure and applied science, but it is equally difficult to distinguish between applied science and mere commercial enterprise; and in confining themselves to pure science the Committee will probably find their task none too easy. Secondly, the catalogue is no longer, like the "Catalogue of Scientific Papers" issued by the Royal Society, to be "confined to papers in certain periodicals, or to books of a certain category." The method now in force at the Concilium Bibliographicum, Zurich, of issuing slips or cards conveying authors' titles, subject-matter, etc., as speedily and as frequently as possible, is proposed to be adopted; while a further issue in book-form may take place at intervals, parts corresponding to the several sciences being, if found desirable, published separately. The circular continues:—

"That, in order to secure the preparation and publication of such an International Catalogue, a Central Bureau shall be established under the control of an International Council.

"That the whole of the Catalogue shall be prepared and issued subject to the authority of the International Council, and that any particular undertakings which may be allotted to particular countries, institutions, or persons, shall be subsidiary to the work of the Central Bureau and subject to its control.

"That the cost of preparing and publishing the said Slip- and Book-catalogues at the Central Bureau during the years 1900–1904, in so far as these are not met by sales, shall be provided for by means of a guarantee fund, and that application be made to governments, learned societies, institutions, and individuals throughout the world, to assist in establishing such a fund."

Other questions to be decided at the Conference are the place of

the Central Bureau, the mode of appointment and organisation of the International Council, the language or languages to be used, and the system of classification to be followed in the subject-index. Since it is difficult to estimate the cost of the work of indexing, it is suggested that a guarantee fund, of about £10,000, should be raised to cover a period of not less than five years, after which time the cost of the enterprise can better be determined.

We may hope that these proposals will be discussed by those whom the scientific world recognises as competent to deal with such peculiarly technical questions. We could name a number of men whose opinions would carry great weight; let us mention the names of M. Baudouin, H. Carrington Bolton, Victor Carus, R. Friedländer, Emil de Margerie, Paul Mayer, Michel Mourlon, S. Nikitin, P. Schiemenz, S. H. Scudder, and O. Taschenberg. We do not mention some skilled bibliographers of our own country, who, till a short time ago, we thought must have been known even to the Council of the Royal Society. By the courtesy of the Secretary of the Royal Society, the list of the delegates already appointed to attend the Conference has been forwarded to us. The names of the delegates for Austria, Germany, and Norway are not yet given. Among the other names, we are glad to see Dr. J. S. Billings and Professor Simon Newcomb, from the United States; Dr. E. W. Dahlgren, the librarian of the Swedish Academy; Professor August Heller, librarian of the Hungarian Academy; Dr. J. Deniker, librarian of the Muséum d'Histoire Naturelle, Paris; and Chevalier Descamps-David and Mr. Paul Otlet, both of the Institut International de Bibliographie at Brussels. But there are also in the list Mr. Avierinos M. Averoff, Greek Consul at Edinburgh; General Annibale Ferrero, Italian Ambassador in London; the Portuguese Minister in London; the Right Hon. Sir J. E. Gorst, M.P., Vice-President of the Committee of Council on Education; the High Commissioner for Canada; the Agent-General for Natal; the Agent-General for New Zealand; the Agent-General for Queensland; and the Swiss Minister in London. These are "all honourable men," deservedly distinguished, but do they know anything of the literature and bibliography of science, or the every-day needs of the working physicist, chemist, and naturalist? If their function is simply to promise the support of their respective governments, especially pecuniary support, then, in the interests of science, we undoubtedly offer them a hearty welcome to London; but when the Conference begins to discuss the Dewey decimal classification, or the best method of indexing new species of animals and plants, we hope that those who know something about the subject will be left to do the talking.

But, once again, to ambassadors, consuls, high commissioners, generals, professors, and librarians, we wish good speed and a successful ending to their discussions.

SOME NEW BOOKS.

"SEMPER ALIQUID NOVI EX AFRICA."

THE GREAT RIFT VALLEY: being the narrative of a journey to Mount Kenya and Lake Baringo, with some account of the Geology, Natural History, Anthropology, and future prospects of British East Africa. By J. W. Gregory. 8vo. Pp. xxi, 422, with maps and illustrations. London: John Murray, 1896. Price 21s.

"IN pioneer exploration England has led the way, but in scientific geography we have always been beaten by our German rivals." So said Dr. Mill in the beginning of the present year, and the truth of his remark, unfortunately, cannot be disputed. Our success and our failure are equally due to national characteristics: to audacity, courage, and love of adventure on the one hand; to one-sided methods of education, and to caring little for anything which does not yield a direct return in money, or its equivalent, on the other. But on the causes it is needless to enlarge; it is a fact that, with a few notable exceptions, British explorers, too often, have added only to our geographical knowledge in the most limited sense of that term. It is, then, a relief to take up such a book as the "Great Rift Valley." Dr. Gregory possesses exceptional qualifications for the task of exploration: in addition to the tact, patience, determination and courage, the readiness of resource, and the coolness in danger, which are essential to success in any attempt to penetrate far into the Dark Continent, his scientific training has been thorough and yet wide. He is no mere specialist; he has won distinction alike in petrology and in palæontology, he has discussed with equal ability problems in Alpine geology, and in the distribution of life, past and present, on the surface of the globe. The trustees of the British Museum, in permitting him to join, as naturalist, an expedition which was designed to explore Lake Rudolf, acted wisely; and if that intention had been fulfilled, its results, doubtless, would have been more copious, though they could have hardly been more interesting, than those of the journey which was actually accomplished.

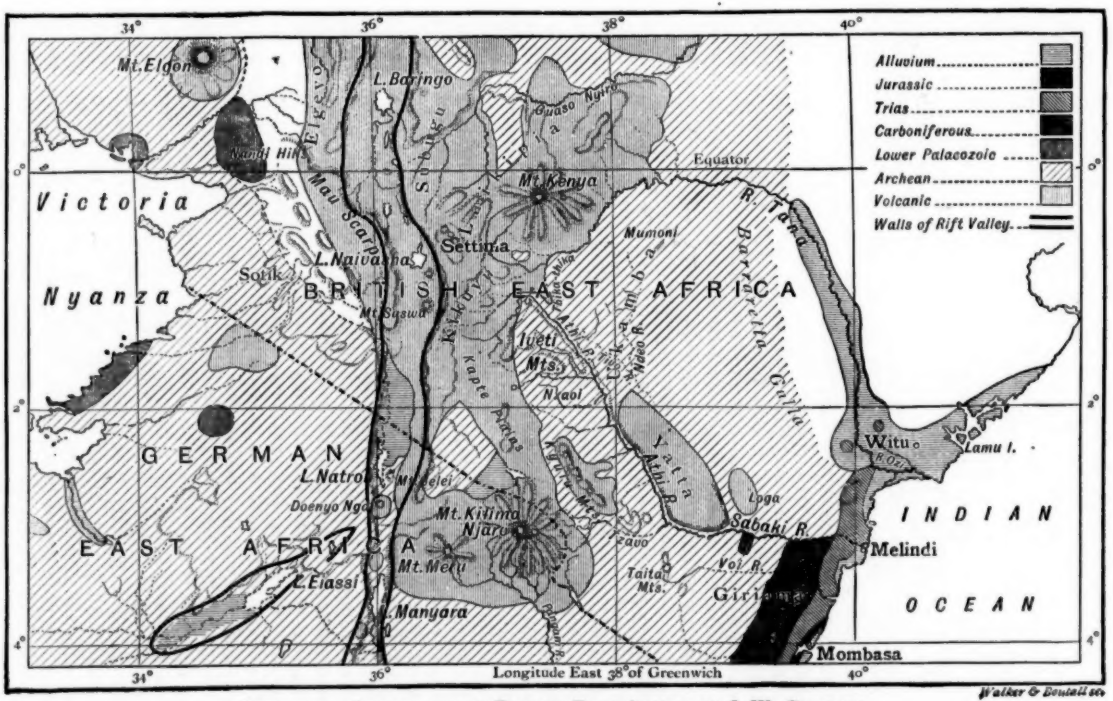
Dr. Gregory has divided his book into two parts: the one a narrative of his journey, the other a general account of the natural history of the country visited. This arrangement will undoubtedly make the book more popular, because scientific disquisitions in the midst of narrative are apt to be as grit in cake to the palate of the ordinary reader, especially at a time when mental digestion is too weak for any food which is not minced into paragraphs or spiced with attempts at epigram; it will also make the scientific information more readily accessible to those who desire to use the volume for purposes of reference. In one or two cases, we think, it would have been better, even at the risk of adding a few pages, to have entered a little more fully into particulars, instead of referring the reader to papers already published by the author in scientific journals, which often are only

accessible to a limited number of readers; but the author has, as a rule, been successful in hitting the happy mean between brevity and diffuseness.

No fates could have seemed more adverse than those which awaited Dr. Gregory on his arrival in Africa: the well-equipped expedition destined for Lake Rudolf went to pieces before it had advanced more than a few days' journey from Mombassa, its leader apparently left it to shift for itself, and Dr. Gregory's sole recompense for having wasted full three months was a couple of bad attacks of fever. Most men would have quitted Africa in disgust. But that is not his way, so he determined to make a dash at Lake Baringo and Mount Kenya. 'Make a dash' is the right term, for his party, of necessity, was small and not too well provided, a belt of country over-run by the formidable Masai had to be crossed, and his time was short. It was, in fact, a record performance. The party, in going and returning, covered 1,650 miles in two days less than five months.

It was formerly held, as Dr. Gregory remarks, that the geology of Tropical Africa was exceptionally monotonous. It was a continent without a history, where, in truth, there was nothing new under the sun. This idea he shows to be very far from correct. No doubt the palæontological record is singularly deficient, for a large area is occupied by gneisses and schists, almost certainly representative of the Archæan era; another area, by no means small, is covered with great sheets of lava. There are, however, some stratified rocks; and the geological record becomes more complete towards the end of the Secondary era, though the explorer is seldom tempted to overload his porters with fossils. In fact, a very large part of Tropical Africa appears not to have been below the level of the sea since geological history began, and even its lacustrine deposits have yielded, as yet, nothing of palæontological interest. But there is much to reward the physical geologist. The country traversed by Dr. Gregory consisted first of the coastal plain, marshy and malarious, but in the British dominions fortunately narrow enough to be crossed in a couple of marches; then of a zone of foot-hills, also narrow. This is followed by a higher and very broad zone, a sandy, barren district, mostly covered with 'scrub.' To this succeeds the ancient backbone of the continent, a highland region of very old rocks which may be traced from the Drakensberg of Natal to the mountains of Abyssinia; possibly even through Eastern Egypt as far as Cyprus. Then comes the great zone of volcanic rocks—wide-spreading sheets of lava, which are crowned here and there by huge cones such as Kilima-Njaro and Kenya, and this is followed by a region, once also highland, but now broken by a series of north and south faults into the 'Great Rift Valley.' Its floor consists of "ancient and modern lavas of various ages, the alluvium of dried lake basins, recent river gravels, and deserts of loose drifting sand." Dr. Gregory was struck by the resemblance between the lava-plains and those about the Snake River of Idaho, and considers these to have been produced by the combination of eruptions from numerous centres, which he proposes to call 'plateau eruptions,' rather than by outpourings from fissures.

But the phenomena afforded by the Rift Valley are yet more interesting to the student of physical geology. The African lakes, as Dr. Gregory points out, fall naturally into two classes: one long and narrow, lying like fjords between steep cliffs; the other rounded in shape and with low shelving shores. Lakes of the former class occur on two lines, which pass on either side of the Nyanza and meet at Lake Rudolf. "Thence the line continues northward as a long strip of low



GEOLOGICAL SKETCH-MAP OF BRITISH EAST AFRICA, BY J. W. GREGORY.

Kindly lent by Mr. John Murray.

land, dotted with lakes and old lake basins, and sinking in places below the level of the sea." It may be traced along the Red Sea, itself like a magnified fjord, up the Gulf of Akaba, and on through the Dead Sea and the Jordan Valley, till it ends on the plain of Northern Syria, after a course of about 4,000 miles. The trough-like form of this sunken district is maintained throughout, and scattered over its floor is a series of over thirty lakes, of which only one has an outlet to the sea. A glance at the sketch-map in Dr. Gregory's volume at once recalls to memory the outline presented by more than one series of volcanic vents in the Pacific and Indian Oceans; and this African district, as we have seen, is a line of eruptive disturbances as well as of faulting. In the Rift region the effect of the latter process has been no less remarkable than unusual. Strips of country have been dropped down by a series of parallel faults, and thus a valley has been formed with precipitous and sometimes step-like sides. Here, then, the valleys often are due to rifts instead of to erosion; the mountains occasionally are formed of blocks instead of by folds, and in some cases the great earth movements have happened so recently that rock scarps 1,000 to 2,000 feet in height still stand bare and precipitous as though broken but yesterday, and straight lines and sharp angles still dominate the scenery.

Dr. Gregory believes that the making of the Rift Valley system was heralded by intense volcanic activity, when first trachytes, then andesites, were ejected. This probably occurred in some part of the Cretaceous period, and was followed in the Eocene by the first of the series of north and south faults which ultimately formed the Rift Valley. Afterwards, probably in the Miocene, came a second series of plateau eruptions (basaltic). Another series of faults, in the same general direction as the earlier one, occurred in the Pliocene, when some of the lake basins were formed, while to the Pleistocene are referred the more recent volcanic eruptions (such as the crater of Kilima-Njaro, with a few cones which still give signs of activity), the last series of Rift faults, and the modern lakes. The basins of these are partly the result of differential movements athwart the general line of subsidence.

In connection with this subject Dr. Gregory makes some remarks upon the Jordan Valley and the Dead Sea, for these have an important bearing upon certain questions of zoological distribution. He believes that in former times a river flowed southward, from Palestine, along that part of the Rift Valley which is now occupied by the Red Sea, and entered the Indian Ocean near Aden. Probably this river, not far from its mouth, was joined by another from the Rift Valley, so that the equatorial lakes were in water-communication with the Jordan, and their fish could reach Palestine without entering the Nile. Dr. Gregory seems to shrink from claiming the Arabah as only a prolongation of the ancient valley of the Jordan, but he goes so near to it that we anticipate he will before long accept this as the simpler solution. Incidentally, also, he discusses the significance of that singular valley, the plain of Esdraelon, which severs northern Palestine and communicates with the valley of the Jordan by gaps, which are only about 300 feet above sea-level. He explains these, rightly in our opinion, as cases where one valley has been 'beheaded' by another, a thing of frequent occurrence in the Alps, but we doubt whether the streams flowing towards the Kishon have trespassed on the heads of the glens draining into the Jordan. As the fall to that river is at least three times as great as it is to the sea, and the course of the streams is much shorter, we think that these would be the

more powerful agents of erosion, and would cut back into the region draining to the west.

Dr. Gregory touches on more than one question bearing upon the distribution of life, but into these, whether they relate to plants, to animals, or to races of men, space does not permit us to enter. South Africa, like other countries, has its Alpine flora, which sets in upon the mountains at about 11,500 feet. He inclines to explain this by assuming an elevation of the land rather than a general lowering of the temperature in former days, but the question, as yet, can hardly be regarded as closed. His observations on Mt. Kenya show that at any rate its glaciers once terminated some 5,000 feet below their present limit. Incidentally, also, in speaking of the extermination of the larger mammals, he offers a solution of one of the puzzles in Pleistocene geology—namely, the not unfrequent occurrence of large accumulations of bones belonging to animals of different species and different habits. These, by many geologists in the past, by Sir H. Howorth in the present, are regarded as the effects of a deluge. But Dr. Gregory points out that it is more probably the result of a defect, not an excess of water. He crossed a district called Laikipia, which had been described to him as one of the richest gamefields of Africa. "Here and there around a water-hole we found acres of ground white with the bones of rhinoceros and zebra, gazelle and antelope, jackal and hyena, and among them we once observed the remains of a lion. All the bones of the skeletons were there, and they were fresh and ungnawed. The explanation is simple. The year before there had been a drought, which had cleared both game and people from the district. Those which did not migrate crowded round the dwindling pools and fought for the last drop of water. These accumulations of bones were therefore due to a drought, and not to a deluge." In Central Africa, we presume, the bones would generally crumble away, but in some lowland regions drought might be succeeded by floods and the skeletons speedily entombed. Possibly, in such a country as Siberia, frost of exceptional severity might produce the same consequence as a drought in tropical climates.

Did our space allow, we would gladly dwell upon Dr. Gregory's exploration of the glaciers of Mount Kenya, where he pitched his camp for a few days at a height of some 15,000 feet, ascending on one occasion to about 17,200 feet, when he was turned back by difficulties which no solitary traveller would have been justified in encountering. Like Mawenzi on Kilima-Njaro, Kenya is a ruined volcano, the actual peak terminating in five pyramids, the highest of which is about 19,500 feet above the level of the sea. It is steep and precipitous, so that apparently it will not be ascended without some difficulty. We trust that when the Masai have been taught to behave themselves, some members of the English Alpine Club will find a way to the summit. Among Dr. Gregory's notes on natural history, some on protective resemblance and on the dispersion of plants are extremely interesting. The frontispiece shows that insects can rival the serpent in guile. His remarks also upon the capabilities of British Central Africa and upon the slavery question are worthy of careful consideration. As regards the latter, he emphatically affirms —what, as a nation, we are too prone to forget—that the moral and intellectual character of a race is not suddenly changed for the better by emancipation, so that the incautious gift of freedom may be for a time a curse instead of a blessing. But we must conclude—the book is one that will well repay study, and it shows that Dr. Gregory can write almost as well as he can explore. T. G. Bonney.

COUNT VON GÖTZEN'S JOURNEY ACROSS AFRICA.

DURCH AFRIKA VON OST NACH WEST. Resultaten und Begebenheiten einer Reise von der Deutsch-Ostafrikanischen Küste bis zur Kongo-mündung in den Jahren 1893-4. Von G. A. Graf von Götzen. Mit zahlreichen Original-Illustrationen von W. Kuhnert und Sütterlin nach den Photographien, und 2 grossen Karten von R. Kiepert nach den Original-Aufnahmen des Verfassers. 8vo. Pp. xii., 418. Berlin: D. Reimer, 1895.

THE active volcanic vents on the earth's surface are at least four hundred in number, counting only the principal cones, besides which numerous smaller vents usually occur in the neighbourhood of the larger orifices. According to some of the older authorities, active volcanoes are found only in islands, or in districts immediately adjacent to the seashore. But this rule, although it may be true in the majority of cases, is by no means invariable. Besides the existence of active volcanoes in the Thian-shan range in Central Asia, which, although once regarded as mythical, has been now completely established by the Russian savants, there are known to us at least three active volcanic districts in the far interior of Africa. On Lake Rudolf, according to the testimony of Count Teleki and Lieut. von Höhnel, there is a perpetually raging volcano on one of the islands, and a large volcanic tract adjacent to it. Donyo-Ngai frightens the natives of the region to the west of Kilimanjaro by its thundering noises and fiery ejections, and has several "smoking companions." And now an enterprising German explorer has reached the volcano of Kirunga, lying south of Lake Albert-Edward on the extreme eastern border of the Free Congo State, and has not only witnessed its eruptions from a distance, but has actually ascended to the rim of its crater.

Count von Götzen, a lieutenant in the Prussian Guards, who has achieved this notable feat of travel during his traverse of Central Africa from east to west, accompanied by Dr. W. von Prittwitz as chief of his staff, and Dr. H. Kerstrug as physician, and attended by a caravan of 620 natives of various origins, left the east coast at Bweni, near the mouth of the Pangani River (about 5° 50′ S. lat.), in December, 1893. It took the party eleven months and eight days to reach the Atlantic at the mouth of the Congo. Passing through the coast-district on to the Masai Plateau they arrived at Kondoa, in Irangi, at the end of January, 1894, and shortly afterwards crossed Baumann's route from south to north. Here the travellers' attention was attracted by the lofty mountain Gurui, which rose conspicuously to an altitude of some 10,000 feet to the left of their route, and a diversion to the west was made in order to ascend it. The attempt was not successful, but a height of over 3,000 metres was reached; and although Gurui is extinct, if it were ever a volcano, and no crater was observed, it is, no doubt, of volcanic origin, and has five or six small volcanic satellites on its southern slope.

At Vurumanangi, on February 10, the party climbed the steep ascent of the western edge of the great Rift Valley, which passes north to Lake Naivasha, and followed its western edge for several marches. Then, turning sharp to the left, they traversed another wide depression, the lowest part of which is occupied by the salt-lake of Nyarasa, and again ascended the plateau. Proceeding onwards they entered Unyamwesi, and on March 10 arrived at the Catholic Mission Station of Msalala, maintained by the "White Fathers" of Algeria. After a few days' rest here, another mission station in Uschirombo, further westwards, kept by the same society, was reached, and three weeks' rest was ordered, during which some of the

carriers were changed and fresh provisions and new porters were obtained from the station of Mwansa on the Victoria Nyanza.

Thus recruited, Count von Götzen and his companions started again on April 14, 1894, with a party of 362 attendants, on their arduous journey through the furthest part of German East Africa, and on May 2 arrived on the Kagera River, the largest feeder of the Victoria Nyanza, and, in fact, the upper stream of the Nile. Two days later the party were safely ferried over the Kagera, here about 250 metres in breadth, in canoes, and the hilly but treeless plateau of Ruanda was entered. While the son of the ruler of Ruanda, who rejoiced in the name of Schirangawe, was easily visible, there seemed to be much difficulty in obtaining an interview with the great "Kigeri" himself, as this native potentate is called. This, however, was effected a few marches further on, and Luabugiri was found to be a veritable giant, wonderfully well-proportioned, and of a light brown colour, like most of the Wahumas, but very shy and not easy to deal with.

After leaving Luabugiri's residence, of which a good illustration is given, the travellers pushed on straight for Mount Kirunga, and, shortly before arriving at its foot, met with a serious difficulty in the shape of a bamboo forest of the densest description. It was not until June 12 that a start was made for the ascent of the mountain, first on an elephant-hunter's path over blocks of lava, and then through very dense forest. Here grey parrots (*Psittacus erithacus*) were noticed for the first time, showing that the limits of the western fauna were being entered upon. Above the forest open ground at length appeared, and after several days of arduous toil the party stood on the edge of the crater of Kirunga, and gazed upon a sea of congealed lava with a large orifice of active eruption in the middle of it. The larger diameter of the oval crater of Kirunga was estimated at 200 metres, and the smaller at 150 metres, while the lava-bottom was calculated to lie from 200 to 300 metres below the rim on which the party stood. The height of the summit of the mountain was estimated at 3,470 metres. To the east of Kirunga were seen the summits of two other lofty mountains—Navunge and Karissimbi, while, according to the map attached to the volume, Mount Ufumbiro of Stanley lies further off behind these mountains, just on the outside edge of the German territory.

After descending from Kirunga the travellers encamped on the shores of Lake Kivu. This hitherto unexplored lake lies at an altitude of about 1,485 metres, immediately to the north of Lake Tanganyika, into which it is believed to drain. A whole chapter is devoted to an account of it and its lovely islands, which appear to be rich in animal and vegetable life of every description.

The main object of the journey having now been accomplished, a grand consultation took place as to the best route of return to Europe, and only after much discussion it was determined to proceed westwards to the Congo. This was, as may be well believed, by far the hardest and at the same time the least interesting portion of the journey, and three whole months were taken in its accomplishment. Starting on June 28 from Kirunga on Lake Kivu, the party crossed into the water-basin of the Congo about five days later, and found themselves on the sources of the Lŏwa, which runs into the Congo at about 1 deg. S. lat. The great wood-district of the Upper Congo thus entered on was crossed far to the south of Stanley's route. Great difficulties from the dense nature of the forest and from the failure of provisions were encountered, and Count von Götzen and his companions would hardly have got safely through had they not found a party of Manyema encamped on the road, by whom they were

assisted forward. Ultimately the Congo was reached at Kirundo, about a hundred miles above Stanley Falls Station, on September 21. Here the travellers were most hospitably received by Baron Dhanis and the officials of the Congo Free State, and, travelling by canoes and steamers, reached the mouth of the Congo, and returned to Europe.

We need not follow Count von Götzen in his disquisition upon the Congo Free State and its successful war with the Arabs, of which he gives a lively account; but we must say a few words about the Appendix to his work, in which are contained several memoirs on the natural history collections made during the expedition. These collections do not appear to have been very extensive, but it will easily be understood that upon such an arduous and prolonged journey it was impossible to convey much more than what was absolutely necessary for the existence of the expedition. Of plants, a collection was made on Kirunga at and above an altitude of 2,000 metres, and has been worked out by Professor A. Engler and his associates at Berlin. These plants are referred to seventy-nine species, so far as they can be accurately determined, and twelve of these are described as new to science. The plants, Professor Engler tells us, belong altogether to types which are found on the other high mountains of tropical Africa —such as *Rubus*, *Trifolium*, *Scheflora*, *Malabaila*, *Æolanthus*, *Pycnostachys*, *Cineraria*, and *Senecio*. These genera are also characteristic of the highlands of Abyssinia, Kilimanjaro, and the Cameroons.

Professor C. A. Tenne likewise gives an account of the rocks and minerals brought home by Count von Götzen; and Dr. Karl Käseberg describes the Coleoptera, which do not appear to have been very numerous, but embrace a few new forms. Finally, we may say that the volume is beautifully illustrated, and furnished with two excellent maps which show the route taken by the expedition from the Indian Ocean to the Congo, and the exact dates on which it arrived at and departed from every station. P. L. S.

SOME SERIALS.

OUR bright and useful contemporary, *Science Gossip*, has emerged from the difficulties to which we have previously referred, by handing over the business control to the Nassau Steam Press, Ltd., 60 St. Martin's Lane, London, W.C., and by omitting the March, April, and May numbers. The June number, which begins vol. iii., contains the first part of an article, by the Editor, on the portraits of scientific men at the National Portrait Gallery, illustrated by Miss J. Hensman. We extract from this number the following editorial note:—

"We sincerely hope that the rumour is unfounded, which Sir Henry Howorth refers to in NATURAL SCIENCE. It is to the effect that the special collection of British Animals at the British Museum of Natural History at South Kensington is to be distributed into the general collection. We feel certain that the result would be most disastrous to the encouragement of natural science studies in this country. We know it is a department which is constantly referred to in an unobtrusive manner by many young naturalists, who thus spare the time and patience of the courteous assistants in the students' rooms. Rather let us hope the collection may eventually be increased by making it a completely typical reference collection, where those of the large number of persons who cannot visit the museum on week-days may on Sundays compare their captures and obscure specimens for identification. No such opportunity elsewhere occurs in London. That the general public are interested in and educated by the special British collection, one may easily find by listening to the surprised and

intelligent remarks made by visitors on seeing gathered together the animals which occur in their own country."

We are sorry to record the death, after a brief existence of six months, of the *Scientific African*, owing to the fact that its editor is called elsewhere to seek his livelihood. It does not appear that the editing of scientific publications is a more remunerative employment in Africa than it is in other parts of the world.

We announced some time ago that the *Annuaire Géologique Universel* of Paris was about to be discontinued from want of support. We are glad to find that this is only partially the case. The fact is that the want of support makes it impossible to carry on the work as heretofore, and the Editor, Dr. L. Carez, announces in his introduction that vol. xi. will be limited to the geology of France. We are now, therefore, quite without a general Geological Record, and likely to remain so until the example of the Zoological Society is followed by geologists.

The Classification of Physiology.

We have received, too late to mention in our article on the Decimal Classification, a report presented to the Société de Biologie de Paris by Messrs. Blanchard, Bonnier, Bourquelot, Dumontpallier, Dupuy, Malassez, and Richet. It is an attempt to extend the numerical classification of physiology, in accordance with Dewey's book, under nos. 581.1 and 612. No attempt has been made to deal with the useful section 591. In what it has attempted the compilers have followed the admirable example of Mr. Baudouin rather than the harum-scarum methods of the Royal Society Committee. "We have sought," they say, "so far as was in our power, to establish parallel series. Thus, the general divisions of physiology are those which agree with the other general divisions of the Dewey classification. There is also a certain parallelism between the numbers: thus, memoirs on comparative physiology carry the zoological numbers. Absolute parallelism was impossible, since different subjects do not always lend themselves to identical classification. Certain numbers have been left blank in such a way as to permit future extension of the classification. . . . To sum up, the classification of memoirs on physiological work by the decimal system is, as a rule, extremely simple, and in those cases where it is difficult, it is clear that the memoir in question would be difficult to class under any classification whatever." The classification is provided with a summary index, which renders it of still greater value. We presume that those interested in the matter can obtain a copy by applying to Dr. C. Richet, 15 Rue Université, Paris.

Literature Received.

Catalogue of the Madreporarian Corals, vol. ii., H. M. Bernard; Catalogue of Snakes, vol. iii., G. A. Boulenger: Brit. Mus. (Nat. Hist.). Thoughts on Evolution, P. G. F.: Sonnenschein. How Plants Live and Work, E. Hughes-Gibb: Griffin. Elementarcurs der Zootomie, B. Hatschek and C. J. Cori; Sporozoenkunde, von Wasielewski; Anatomie der Wirbelthiere, pt. i., A. Oppel: Jena, Fischer. Flora of Dumfriesshire, G. F. Scott-Elliott: Dumfries, Maxwell.

Report: Free Library, Bootle. Report: Colombo Museum. Report for 1895: Wood's Holl Lab. Geology of Woodbury Co., Bain; Geology of Warren Co., Tilton: *Ann. Rep. Iowa Geol. Survey*. Studies from Psychological Lab. Yale University, iii. *Proceedings Roy. Soc. Victoria*, vol. viii. Weasels of E. North America, Mammals from Lake Edward, Florida Deer, O. Bangs; Lemmings of genus Synaptomys, American Bears, C. H. Merriam; Violets of Atlantic Coast, C. L. Pollard; Mammals of Columbia, V. Bailey; Additions to Flora of Washington, T. Holm; New Species of Madagascar Plover, C. W. Richmond: *Proc. Biol. Soc. Washington*.

La Naturaleza, ii., nos. 8 and 9. The Ornithologist, June. Popular Science News, Jan. to June, 1896. Nature, May 21, 28, June 4, 11. Literary Digest, May 16, 23, 30. Revue Scientifique, May 16, 23, 30, June 6, 13. Irish Naturalist, June. Feuille des j. Naturalistes, June and July. Naturen, April, May. Nature Notes, May. Amer. Journ. Science, June. Naturæ Novitates, May. American Naturalist, June. Victorian Naturalist, April. Science, May 8, 15, 22, 29, June 5. Scott. Geogr. Mag., June. The Naturalist, June. Westminster Review, June. American Geologist, June. Botanical Gazette, May. Knowledge, June. Biology Notes, May. Photogram, June.

OBITUARY.

GABRIEL AUGUSTE DAUBRÉE.

BORN JUNE 25, 1814. DIED MAY 29, 1896.

EXPERIMENTAL Geology has lost, by the death of Professor Daubrée, one of its foremost exponents—a man who may be regarded as having been almost the founder of the French synthetic school. Much of his long life was devoted to the prosecution of chemical, physical, and mechanical experiments, whereby he sought, with singular success, to imitate in the laboratory many of the phenomena of nature. Light was thrown by his researches upon various subjects, which in an exceptional way need illumination; such as the origin of mineral veins, the thermal and dynamic metamorphism of rocks, and the nature and affinities of meteorites.

Daubrée was born at Metz, but received his scientific training at the Polytechnic School in Paris and passed thence to follow the profession of a mining engineer. At the age of only twenty-five he was called to the chair of mineralogy and geology, then recently created at Strasbourg—a position which he held for upwards of twenty years. Early in his career he suggested an explanation of the origin of deposits of tin-ore, insisting on the important part which compounds of fluorine had probably played in their production, and supporting his views by appeal to experiment. For his observations on the recent formation of iron ores in lakes and bogs he received the medal of the Dutch Society of Sciences at Haarlem. The distribution of gold in the Valley of the Rhine was another subject which occupied his attention, and while at Strasbourg he prepared a geological map, with description of the department of Bas-Rhin. His most successful efforts in synthetic mineralogy were those in which he studied, under circumstances of much difficulty and some danger, the action of superheated water on glass, and thereby produced artificial crystals of quartz, augite, and certain zeolitic minerals. The production of zeolites during historic times was strikingly demonstrated by his classical study of the action of thermal waters on the brickwork at the old Roman Baths of Plombières.

In 1861 Daubrée followed Cordier as professor of geology in the Natural History Museum in Paris, and was elected into the French Academy as Cordier's successor. Subsequently he became professor at the School of Mines, and in 1884 he retired with the title of Honorary Director of this institution.

Professor Daubrée was a prolific writer, his best known work being a large treatise published in 1879 under the title of "Etudes synthétiques de Géologie Expérimentale," wherein he collected the results of his experimental work which had been recorded in the *Annales des Mines* and other scientific journals. The year after this publication he received from the Geological Society of London the Wollaston Medal, appropriately awarded during the presidency of Dr. Sorby, whose work as an experimental geologist had run to some extent in a parallel direction. Another of Daubrée's important works was his three-volume treatise entitled "Eaux Souterraines," which appeared in 1887.

Professor Daubrée was formerly a frequent visitor to England, where he was endeared to a large circle of scientific friends, many of whom are now passed away. Twenty years ago he delivered an address on his favourite topic at the Science Conferences held in connection with the Loan Collection of Apparatus at South Kensington. A man naturally of simple habits and warm affections, unaffectedly modest, yet saturated with scientific enthusiasm, Daubrée lived and died beloved as a friend by those who knew him, and admired by all as an original investigator of the first rank.

F. W. R.

FRIEDRICH GERHARD ROHLFS.

BORN APRIL 14, 1831. DIED JUNE, 1896.

ROHLFS, one of the most celebrated explorers of the northern part of the African Continent, was born at Vegesack in 1831. Taking up medicine as a profession he entered the French Foreign Legion, and acted as surgeon to the forces employed in Algeria from 1855 to 1860. Adopting Mohammedan costume and custom he made an expedition through Morocco in 1860, and from that time onwards continued his explorations of northern Africa. Among other places visited by him may be mentioned Abyssinia, Tripoli, Egypt, the Libyan desert, and the Sahara. In 1870, Rohlfs made his home at Weimar, and subsequently resided there when not on his travels. He had visited America, and in 1884–85 was German Consul at Zanzibar. He published numerous books on his travels.

HENRY BARGMAN POLLARD.

BORN 1869. DIED JUNE 14, 1896.

WE deeply regret the premature death of this investigator, who was accidentally drowned while bathing at Dover. He had received his first appointment last year as lecturer on biology in Charing Cross Hospital. Dr. Pollard was a Scholar of Christ Church, Oxford, whence he obtained a research scholarship on taking his degree. He proceeded to study in the Anatomical Institute of the University of Freiburg, and next, in 1892, occupied the Oxford University table in

the Naples Zoological Station. In 1893 he returned to England, first to work in the Biological Laboratory of University College, London, and then becoming Berkeley Fellow of the Owens College, Manchester. His original researches dealt mainly with the anatomy and development of fishes, and he arrived at very heterodox views on certain morphological questions. His first memoir, on the anatomy and phylogenetic position of *Polypterus* (*Zool. Jahrbücher*, 1892), advocated the close affinity of this fish with the ancestry of the Amphibia. In his next memoir (*op. cit.*, 1895) he considered that the tentacles of the higher fishes were homologous with the oral cirri of *Amphioxus*. He also investigated the "lateral line" system of the Siluroids, and made many observations on the development of the suspensory apparatus of the jaw in some of the higher bony fishes.

THE Rt. Hon. THOMAS LYTTLETON POWYS, fourth Lord Lilford, died on Wednesday, June 17, aged 63. He was president of the British Ornithologists' Union, and, at Lilford Hall, near Oundle, in Northamptonshire, he had a remarkably fine collection of birds, both alive and dead. It is not long since his work on the birds of his own county was published. British ornithologists will regret the loss of so prominent a colleague.

WE regret to learn of the death of Mr. H. C. LEVINGE, of Mullingar, Ireland. At one time an enthusiastic collector of Indian ferns, he afterwards gave himself up to the study of the Irish flora, to which he added several species. Mr. Levinge will be greatly missed by the many botanists to whom he extended his hospitality and his help.

THE well-known professor of zoology and anthropology at Moscow, ANATOLY BOGDANOFF, died last April, at the age of 62. He was the author of a "Chrestomathy of Zoology," the founder of the "Society of Lovers of Natural Sciences," and editor of the valuable publication "Materials for the History of Zoology."

WE have also to record the deaths of: on May 21, in Bohemia, CARL M. BALLING, a distinguished metallurgist, and writer of a number of treatises; on January 14, at Brussels, ANTOINE DUVIVIER, a distinguished student of Coleoptera; Dr. HERMANN STIEDA, assistant in clinical surgery at the University of Tübingen, aged 28; on February 11, at Chestnut Hill, Mass., Dr. D. D. SLADE, lecturer on comparative osteology at Harvard University, aged 71; General T. L. CASEY, a well-known coleopterologist, in Washington, on March 25; H. E. BAUER, an authority on Brazilian geology, in Xiririca, on February 21; Rev. H. WALLER, an ardent researcher among African flora, in Northamptonshire, on February 22; J. FLOHR, a collector of Mexican Coleoptera, in Vera Cruz.

NEWS OF UNIVERSITIES, MUSEUMS, AND SOCIETIES.

We note among recent appointments:—J. H. Ashworth, to be Lecturer in Zoology at Owens College; Dr. P. Vuillemin, to be Professor of Botany at Nancy; Dr. Dannenberg, to be Privat-docent for Mineralogy and Geology in the Technical School at Aix-la-Chapelle; Dr. G. Karsten, of Leipzig, to be Privat-docent in Botany in Kiel University; Dr. O. L. zur Strassen, to be Privat-docent in Zoology at Leipzig University; Dr. E. Albrecht, to be Assistant in Anatomy in Munich University; Dr. H. Enders, of Breslau, to be Professor of Anatomy in the University of Halle; Professor A. Zimmermann, of Tübingen, to be Privat-docent of Botany in Berlin University; Dr. K. Busz, of Marburg, to be Professor of Mineralogy; Professor R. Semon, of Jena University, to be Prosector for Comparative Anatomy, Histology and Embryology; J. Briquet, to be Director of the Delessart Herbarium in Geneva; Dr. H. Baumhauer, of Lüdingshausen, to be Professor of Mineralogy in Friburg, Switzerland; W. W. Rowlee, Instructor in Botany in Cornell University, to be Professor; Dr. George A. Dorsey, of the Peabody Museum, to be Curator in the department of Anthropology at the Field Columbian Museum, Chicago, his place being taken by Frank Russell; Harry Landes, Professor of Geology in the State University of Washington, to be State Geologist; Dr. E. B. Sangree, to be Professor of Pathology and Bacteriology in the Vanderbilt University, Nashville, Tenn.; Dr. N. L. Britton, to be Director of the New York Botanical Gardens, being succeeded as Professor of Botany at Columbia University by Professor L. M. Underwood; Dr. Frank Boas, to be Lecturer on Physical Anthropology in Columbia University.

Mr. Clements R. Markham, President of the Royal Geographical Society, has been raised to the dignity of K.C.B.

Sir Archibald Geikie was one of those made an honorary D.C.L. of Oxford at the Encœnia on June 24. The Buda-Pesth University has conferred honorary degrees on Mr. Herbert Spencer, Sir Joseph Lister, Lord Kelvin, Professor Pierre Berthelot, Dr. W. Roux, Mr. J. S. Billings, and Professor R. Virchow. Durham University has conferred the honorary M.A. degree on Mr. Richard Howse, Curator of the Newcastle Museum, and that of D.C.L. on Dr. Dallinger, F.R.S.

The Rolleston Memorial Prize of the Universities of Oxford and Cambridge has been awarded to Mr. H. M. Vernon, B.A., of Merton College, Oxford.

Mr. J. C. Willis, late Frank Smart Student of Caius College, Cambridge, has been appointed Director of the Royal Botanic Gardens of Ceylon. The value of the Frank Smart Studentship, hitherto £90 a year, is immediately to be raised to £100 a year by the original founders, Mr. and Mrs. Smart, of Tunbridge Wells, as a testimony of their satisfaction at the results of their endowment.

We regret to learn that Professor F. Jeffrey Bell has found it necessary to resign the Chair of Comparative Anatomy and Zoology in King's College, London, in consequence of the effects of influenza. We are informed that no successor will be appointed at present, but that the post will remain vacant, its duties being undertaken by other members of the staff.

THE Austrian Academy of Sciences has elected as honorary members Professor G. G. Stokes and Mr. C. L. Griesbach, the Director of the Geological Survey of India, who is now home on furlough.

WE have received the programme of the summer course that is to be held in Jena during August. The natural science section, which begins on the 3rd and ends on the 15th, is for teachers who have had an academic training, and is open to foreigners. The following lectures are announced: Principles of Natural Philosophy from the Modern Standpoint, Dr. Auerbach; the Structure and Life of Plants, illustrated by experiments suitable for schools, Dr. W. Detmer; Introduction to Microscopic Botany and Experiments in Plant-Physiology, Dr. W. Detmer; Introduction to Modern Zoology, with practical work, Dr. Römer; with other lectures on physical, psychological, and philosophical subjects.

THE seventh session of the Biological Laboratory of the Brooklyn Institute of Arts and Sciences, under the direction of Professor H. W. Conn, will be held at Cold Spring Harbour, Long Island, for six weeks, starting on July 3.

THE Geological Survey of Kansas, carried on under the auspices of the University by Professor E. Haworth and his assistants, has published its first volume. This may be had by sending the cost of postage (22 cents) to Chancellor F. H. Snow, University of Kansas, Lawrence, Kansas.

THAT excellent idea of half covering the skeleton with a papier-maché representation of the outline of the fleshy parts, of which so fine a specimen is to be seen in the man and the horse in the Central Hall of the British Museum (Natural History), is likely to be applied to the Cetacea. At least, we imagine that this method of exhibition is to be one of Sir William Flower's improvements, for we have noted a beluga treated this way in the old whale room. No doubt when the new whale gallery is opened we shall see for the first time the appearance of these huge animals in the flesh, and Sir William Flower will once more have shown that in his opinion the Museum belongs to the public quite as much as to the curator. It is surprising how much energy is being spent at the Museum, and when we consider the lethargic nature of museums as a rule, it is remarkable to see how rapidly the science changes and improves at the Natural History Museum.

WE saw, a short time ago, that some new museum buildings were projected at Brighton, not before they were wanted. Miss Agnes Crane informs us that the plans are indeed passed, but that the money has not been borrowed; and we now learn from the *Brighton Herald* that the Town Council has some idea of carrying out an alteration and enlargement of the public library and news-room, leaving the museum and art gallery for some future occasion. Even if the plans are carried out, there will not be so large an extension of the natural history portion of the museum as is desirable, since a large room, already taken from it for pottery exhibits, will not be returned to it, but incorporated in the new art gallery. This is the more to be regretted, as, when the site is once covered, there can be no further extension. A guide to the Brighton Museum will shortly be published, and the new illustrated catalogue of the Booth bird-collection of British birds is now out at the price of 1s.

WE have received the Report of the Trustees of the South African Museum for 1895. Pending the arrival of Mr. W. L. Sclater, the newly-appointed curator, who will superintend the transference of the collections into their new building, L. Peringuey has been acting curator. Constant attention has kept in check the various insect pests, especially the "incredible numbers of that scourge of zoological collections, the *Anthrenus* beetle," and Mr. Peringuey naturally looks forward with relief to the air-tight iron and glass cases, on Dr. A. B. Meyer's system, which will form a feature of the new fittings. These cases are to be supplied by Chubb and

Son's Safe Company, and it is estimated that the total expense connected with them will amount to £7,500. In view of the greatly increased requirements of the new museum, the annual subsidy has been raised from £1,600 to £2,000. During the past year the number of visitors was 38,054, some 8,000 more than had previously been registered. The increase is in part attributed to recent events in the Transvaal. "Visits from the inhabitants of Cape Town are comparatively rare." Among recent additions is a skin and skeleton of the square-nosed rhinoceros, *R. simus*, presented by the Hon. C. J. Rhodes, and to be mounted at his expense by Rowland Ward and Co. It is intended to model this with the nose six inches from the ground, and the apex of the horn touching the ground, a position vouched for by Mr. Selous. Mr. Peringuey points out the difficulty of acquiring fresh specimens of the large South African Mammals: elephants are dangerous, hippopotami are eaten by crocodiles, Tsitutunga antelopes live in malarial marshes, the gemsbok is protected by game-laws, and the attention of our mighty hunters is directed to the Matabele. Dr. G. Corstorphine, the keeper of the geological and mineral department, has re-arranged the minerals, and has personally obtained many specimens from the chief South African mining areas. It is intended that the collections made by the officers of the Geological Commission shall be stored in the museum, and, so far as desirable, placed on exhibition, while in time maps, diagrams, and sections will be available for illustration of the local geology. Some remains of fossil reptiles obtained by Mr. E. H. L. Schwarz from the Prince Albert district of the colony are being developed by him. The services of a mason, a taxidermist, and an artist modeller are much to be desired at this museum. We are glad to see that the Trustees encourage co-operation with other local institutions. Mr. Corstorphine has given several demonstrations to the South African College students, and hopes in the new museum to be able to extend them to others of the public. The entomological collection and library have been placed at the disposal of the Government Entomologist, with the suggestion that the museum should benefit by his researches. The Trustees also suggest "that the services of the Marine Biologist be secured in the same manner, which could be done to the mutual advantage of the Department of Agriculture and of the Museum."

Visitors to Paris during the summer ought not to miss the very interesting exhibition that has been opened at the Musée Guimet since April 21. There are exhibited here numerous collections brought back of late years from different parts of the world by French explorers. Among them are objects of ethnological interest from Cambodia, Thibet, Corea, Japan, and Siberia.

Science states that a catalogue of the types and figured specimens of fossil animals in the U.S. National Museum has recently been completed, and includes 3,644 species. This, we believe, is a slip-catalogue, and we do not know whether its publication is contemplated.

The Royal Geographical Society's Medals have been awarded as follows: the Founder's Medal to Sir William Macgregor, for services in connection with the exploration and mapping of British New Guinea; the Patron's Medal to Mr. St. George Littledale, for his journeys in Central Asia and the Pamirs; the Murchison grant to Yusuf Sharif Khan Bahadur, native Indian surveyor, for work in Persian Baluchistan; the Gill memorial to Mr. A. P. Low, of the Canadian Survey, for explorations in Labrador; the Back grant to Mr. J. B. Tyrrell, also of the Canadian Survey; and the Cuthbert Peek grant to Mr. Alfred Sharpe, for journeys in Central Africa.

The National Home-Reading Union will hold its Eighth Summer Assembly at Chester, from June 27 to July 6. Natural science will be represented by J. E. Marr and G. F. Scott Elliot, who are to lecture on the geology and botany of the district respectively, while H. Y. Oldham is to give a lecture on geography. Some interesting excursions are planned. Further information may be obtained from Miss Mondy, Surrey House, Victoria Embankment, W.C.

THE Congress of delegates from various natural history societies in the South-eastern district of England was held at Tunbridge Wells, on Saturday, April 25. It was decided to form an association called the "South-eastern Union of Scientific Societies," under the presidency of Rev. T. R. R. Stebbing, with Mr. G. Abbott, of Tunbridge Wells, as Secretary. The object of the union is to aid the co-operation of the societies and to promote their scientific work. It will probably be a link between the smaller societies of the district, which publish no Transactions, and the British Association, since the latter body only permits publishing societies to be affiliated to it. Similar unions in other parts of the United Kingdom, such as the Union of Irish Field Clubs and the Midland Union of Natural History Societies, have already done much good work. Various papers of more or less practical nature were read at the recent congress. We would suggest to the members that more good would probably be done on future occasions by practical and business-like proposals for the organisation of their energies, but of course not much of this could be attempted before the union was fully formed.

AT the annual general meeting of the British Ornithologists' Union on April 22, Mr. P. L. Sclater brought forward a scheme for a new synopsis of the described species of birds, to be arranged in six volumes corresponding to the six zoological divisions of the earth's surface. This has been referred to a committee.

THE Oxford University Junior Scientific Club has brought out a special conversazione-number of its journal, price 1s. The information of chief interest to our readers that we glean from this is that a set of anthropometrical apparatus has recently been presented by Mr. Francis Galton to the Department of Human Anatomy. The eminent donor was himself present at the conversazione, and superintended the use of his instruments, which were on this occasion for the first time exhibited in systematic working order to an Oxford audience.

THE Tyneside Naturalists' Field Club celebrated its fiftieth anniversary on May 20 in a somewhat appropriate fashion. The assembled members traversed the same ground as that of the first meeting fifty years ago, from Prudhoe to Ovingham, and through the woods to Whittle Dene. Of the original membership some ten now survive, among whom we may mention Dr. Embleton, Rev. Canon Greenwell, James Hardy, Richard Howse, Professor D. Oliver. The club is the third oldest society in the north, the Natural History Society of Northumberland, etc., having been founded in 1829, and the Berwickshire Naturalists' Field Club in 1831. The Rev. Canon Tristram is the present President. Mr. George Harkus, the Sheriff of Newcastle, presided over the tea in the evening and made some congratulatory remarks.

THE Geographical Association has sent to various examining bodies a memorial approved by the Geographical Societies and the Teachers' Guild, requesting that the teaching of geography should be based on physical principles, and that the examinations should lay stress upon the scientific aspects of geography.

THERE has just been founded a "Société suisse des traditions populaires," intended to study the folk-lore and customs of the different Cantons. It will probably publish a review. The subscription is 3 francs per annum, and further information may be obtained from Mr. S. A. Stuckelberg, of Zurich.

THE New York Academy of Sciences has formed a new section devoted to psychology, anthropology, and philology, which will hold meetings on the fourth Monday in each month during the academic year. There has also been started in New York an Anthropological Club for informal discussion.

CONGRESSES and meetings are to be held as follows:—German geologists at Stuttgart in August; German naturalists at Frankfort-on-Main, from September 21 to 26; the Swiss Society of Natural Science at Zurich, from August 2 to 5, during

which time the Society of Natural History of Zurich will celebrate its 150th anniversary; the American Association for the Advancement of Science in Buffalo, N.Y., from August 24 to 28; and at the same place the Botanical Society of America, on August 21 and 22.

In December, 1894, we gave an account of the work in connection with high-roads being accomplished by the U.S. Geological Survey (vol. v., p. 406). We now learn that a bill is now before the American House of Representatives to create a Special Commission on Highways, consisting of the Chief of Engineers of the Army, the Director of the Geological Survey, and the Chief of Road Inquiry of the Department of Agriculture. It is to undertake the scientific location of highways on the public domain; the employment of the Geological Survey in the discovery of road materials; the free testing of all road materials offered; the construction of model roads, and instruction in road-making at agricultural colleges and experimental stations.

Mr. T. D. A. Cockerell, of the New Mexico College of Agriculture at Las Cruces, finds himself, like so many enthusiastic scientific men in America, forced to leave his post for political reasons, on June 30. He intends, however, to stay in the country and to go on with his work, especially the agitation for educational reform, and he invites his brother naturalists to join him in founding a biological station in New Mexico. Three years' experience have convinced him of the great value of the climate of that part of New Mexico in the earlier stages of phthisis, and he has himself largely profited by its curative effects. Notwithstanding the abundant energy of the American workers, there is still much to be done in this distant quarter of the Southern States, where the exuberance of interesting forms of life, especially among the insects, is remarkable.

Professor D'Arcy Thompson and Mr. G. E. Barrett Hamilton have been sent by the Government to Alaska to study the causes of mortality among seals in the N. Pacific and Behring Sea. The commission appointed for the same purpose by President Cleveland consists of Dr. D. S. Jordan, Lieut.-Commander Moser, Dr. L. Stejneger, Mr. F. A. Lucas, and Mr. C. H. Townsend.

Dr. Bashford Dean is to conduct an expedition of students from Columbia College, N.Y., including one botanist and three zoologists, to explore Puget Sound, south of Vancouver Island. The party will have the use of the U.S. Fish Commission ss. "Albatross."

To the numerous proposed Antarctic expeditions that we have lately mentioned must be added the one which it is proposed should be undertaken by the German nation. A plan and estimates for this have been published in the *Verhandlungen* of the Geographical Society of Berlin.

Léon Diguet, who has recently returned from a scientific exploration in Mexico, is being sent out again by the French Minister of Public Instruction. He proposes to study the Indians of Guadalajara, Sinaloa, and Sonora, as well as the Cahuila Indians of S. California. Dr. M. Raciborski, of Munich, has been sent to the Buitenzorg Botanical Gardens. Professor V. F. Brotherus, of Helsingfors, has gone to Central Asia to work out the bryological mountain flora of Issikul. A party of four, under the direction of Mr. T. H. Mobley, will start from Lacomb, Alberta, to explore Northern Canada from Edmonton to the Arctic Sea. The trip is to occupy two years.

The Fort Pitt Street Railway Company, of Pittsburg, has, says *Science*, given $100,000 for a zoological garden at Highland Park.

A section of seismology has been created at the meteorological observatory at Athens, under the direction of Mr. Papavasiliou. Its labours will be recorded in a monthly *Bulletin*.

CORRESPONDENCE.

The Function of Stomata.

The writer of the article entitled "Verworn's General Physiology," in the June number of Natural Science, is surely ignorant of the recent work on the gaseous exchange of foliage leaves, when he terms Verworn's statement, "that plants absorb their gaseous food through the stomata," a curious slip.

Stahl (*Chem. Centralbl.*, 1894) has shown that when the stomata of a leaf exposed to normal assimilative conditions are blocked, no formation of starch takes place; and more recently, Blackman (*Proc. Roy. Soc.*, 1895) has definitely settled the question for carbon dioxide by the employment of an elaborate and delicate apparatus for the estimation of this gas, and has come to the conclusion that, under ordinary circumstances, the sole pathway in and out of the leaf is by means of the stomata. Although the passage of oxygen has not been worked out, yet, as this gas diffuses more quickly through fine openings than carbon dioxide, it is natural to suppose that its chief entrance and exit is also through the stomata. Thus the whole gaseous interchange of the leaf and the atmosphere appears on a more rational basis than that on the old view of the passage through the cuticle, upheld until lately by some botanists, but now untenable.

Trinity College, Cambridge. J. Parkin.

[We are obliged for Mr. Parkin's correction. Our contributor must have overlooked a note published in Natural Science (vol. vi., p. 228, April, 1895), in which the result of Mr. Blackman's observations was given.—Ed. Nat. Sci.]

The Retort of the Systematist.

One would have thought that the time was long since past when a journal of the standing of Natural Science would publish, under editorial sanction, such sneers at the systematic naturalist as are contained in the review of Professor Miall's work, in the April number. "The systematist, like the bibliographer, is necessary, and there are faculties that may be trained by the pursuit of either industry." "Of course, Professor Miall, like *every other scientific man*, knows the retort that the systematist will make." It appears to be the reviewer's opinion, as perhaps also Professor Miall's, that the "systematist" is only a sort of necessary evil, and not a "scientific man." It was the fashion a dozen or more years ago for the morphologist, and especially the microscopic morphologist, to express such opinions as does your reviewer, and point, by way of contrast, to the *real* scientific work that he himself did; he even yet appears to have a lingering contempt for the "systematist." But these morphologists are now in danger of falling into the same contempt from the real naturalist—"those who turn their back on the broad field of nature to peer through a microscope at an infinitesimal portion of it." These are not the exact words of Dr. Merriam, but they express his idea as well as that of most real naturalists. The actual fact at the present time is that the "systematist" represents the highest type of the naturalist, and no one can be a good naturalist who is not more or less of a systematist. If natural history means the habits of plants and animals only, or their physiology, then perhaps the systematist is not much of a naturalist. If it means structure and relationships as well, then he is in a high sense a naturalist. Pray let us hear no more of the cry that a systematist is a necessary evil. He who gives utterance to such views only betrays his own

narrowness and incompetence. Such men as Cope, Allen, Merriam, Coues, Scudder, Agassiz, Gill, and a score of others in America, and as many other bright lights in England, are systematists. Do let us concede that they are naturalists and scientific men also.

Lawrence, Kansas, U.S.A. S. W. WILLISTON.
May 24, 1896.

[We beg to refer Professor Williston to the Notes on pp. 1–4 of the present number.—ED. NAT. SCI.]

WHAT IS A "DIAGNOSIS"?

THANK you for your note on my paper containing descriptions of new Coccidæ. The only comment it seems worth while to make is in regard to the use of the word Diagnosis. I presume that you will agree that descriptions which accompany names proposed for new species are diagnoses, rather than full descriptions; that is to say, they aim to present the characters peculiar to the object in question only, or, at any rate, those which distinguish it, taken together, from similar forms. Now my idea of a brief diagnosis, such as those I aimed to give in my paper, is something which will distinguish the species from all species previously known, but which does not necessarily present all the distinguishing characters of the species. A full diagnosis, on the other hand, would give many more characters, with a view to distinguishing the species from others which might be discovered in the future. Even then it is scarcely possible that the list of distinguishing characters would be exhausted; because, for example, in describing an insect, one never mentions the internal anatomy at all, although if one took the trouble to examine it, I suppose it would present some specific peculiarities.

Mesilla Park, N.M. THEO. D. A. COCKERELL.
May 13, 1896.

[As regards the Diagnosis, our view is that of Linnæus and the masters of systematic description. The diagnosis of a genus gives, as concisely as possible, the characters by which the genus is distinguished from other genera of the same family. The diagnosis of a species gives, equally concisely, the characters by which the species is distinguished from other species of the same genus. Such distinguishing points are known as "diagnostic characters." The diagnosis of a family should not repeat ordinal characters, that of a genus should not repeat family characters, that of a species should not repeat generic characters.

What Mr. Cockerell calls "a full diagnosis," we prefer to call a "Description." This should be kept distinct from the diagnosis, and, without being verbose, should be as clear and complete as possible. Probably it will describe many characters that are not diagnostic, but which either confirm the ascription of the species, genus, or family to its place in the system, or which may prove diagnostic some day, when future species, genera, or families are discovered. As a general rule the discovery of a new species necessitates the reconstruction of the diagnoses of some, at least, of the species previously known. This is the work that has from time to time to be done by the monographer; nevertheless, it is incumbent on every describer of a new species to indicate the changes that it renders necessary in our conception of other species. The construction of satisfactory and congruent diagnoses is one of the hardest tasks that a naturalist can set himself. For this reason it is generally shirked by the ordinary species-monger, whose work is on the scientific and literary level of an auctioneer's catalogue.

As for Mr. Cockerell's final sentence, it is charming in its innocence. Mr. Cockerell, it appears, never mentions, much less examines, the internal anatomy of the numerous species he publishes in all quarters of the world. The sooner he "takes the trouble" to do this the better; he will find, to take a single instance, that the genitalia of insects afford not the least certain of criteria, as has been amply proved by such eminent workers as Messrs. Salvin and Godman, and as was again insisted on by Messrs. Elwes and Edwards in the revision of the Hesperiidæ that they communicated to the Zoological Society of London on June 2. To the morphologist we say that external characters have a morphological value; and to the

systematist we say that characters of internal anatomy have a systematic value. "This was sometime a paradox, but now the time gives it proof." Let Mr. Cockerel recognise this in his new biological station, and we shall have fewer papers from him on "physiological species."—ED. NAT. SCI.]

DAS TIERREICH.

PERMIT me to note, with reference to your critic's remark on p. 308 of vol. viii., that Bory de St. Vincent subscribed his articles Bory simply (his full name was Jean Baptiste George Marie ——). We can, therefore, by following Bory's own example, save even more space than suggested. THEO. GILL.

SOME CORRECTIONS.

THROUGH an error in the MS. copy of Professor Gill's review of Boulenger's "Catalogue of Perciform Fishes," in vol. viii., the name *Stereolepis* was omitted from the list of genera on p. 340, and the date of "*Plectroplites*, Gill," p. 341, appeared as 1872 instead of 1862.

A CORRESPONDENT writes that the statement recently made in NATURAL SCIENCE that Congress had appropriated money for a much-needed new building for the U.S. National Museum is unfortunately incorrect. The bill, it is true, has passed the Senate, but it is very doubtful if at this time it will pass the House of Representatives. Meantime, nearly one-half the museum is closed, partly for repairs, but chiefly on account of radical re-arrangements necessitated by the crowded condition of the exhibition series. Some slight relief will be afforded soon by the erection of galleries, for which provision has been made in this year's appropriation. This, however, will not help the reserve, or study series, which is mainly cared for in the exhibition halls owing to the glaring error of constructing the museum building without attic or basement for storage.

NOTICE.

TO CONTRIBUTORS.—*All communications to be addressed to the* EDITOR *of* NATURAL SCIENCE, *at* 22 ST. ANDREW STREET, HOLBORN CIRCUS, LONDON, E.C. *Correspondence and notes intended for any particular month should be sent in not later than the* 10*th of the preceding month.*

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It will shortly be necessary to RAISE *the price of Vols. I.–IV. still further.*

FIG. 1.

FIG. 2.

AMBER covered with

(1) *Balanus porcatus*, da Costa, and (2) *Pomatoceros triqueter* (L.)

(In the possession of Mrs. A. Fox, of Cromer.)

[*See p.* 103.